

Advanced Environmental Dynamics

Specialist Consultants

DAUNIA MINE

**DAUNIA WEST INFRASTRUCTURE
PROJECT**

AIR QUALITY ASSESSMENT

Report # 852001

Prepared for:

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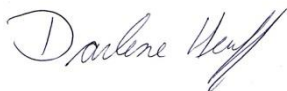
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Executive Summary

Advanced Environmental Dynamics Pty Ltd (AED) was commissioned by SLR Consulting Australia Pty Ltd on behalf of Whitehaven Daunia Pty Ltd (WHC) to undertake an air quality assessment of Daunia Mine's (DNM) West Infrastructure Project (the Project) in support of an Environmental Authority (EA) amendment application.

Project Background

The Project involves the construction and operation of an out-of-pit dump to the west of, and adjacent to, ML1781, off-lease from DNM.

Daunia Mine Environmental Authority Conditions

Under DNM's Environmental Authority (EA) (Permit Number EPML00561913), the requirement to demonstrate compliance with air quality objectives specified in Schedule B of the EA is triggered by a request from the administering authority (Condition A11). Specifically, Schedule B includes ambient air quality objectives for the monthly average of dust deposition (Condition B4(a)) and the 24 hour average concentration of particulate matter with an aerodynamic diameter less than 10 micrometres (PM_{10}) (Condition B4(b)) (Table A). To date, AED understands that in relation to air quality, Condition A11 has not been triggered.

Additional pollutants and/or averaging periods of interest to the administering authority that have been considered in this assessment include: the annual average of total suspended particulates (TSP), the annual average of PM_{10} as well as the 24 hour and annual average concentration of $PM_{2.5}$.

A summary of the air quality assessment objectives is presented in Table A.

Table A: Air Quality Assessment Objectives

Pollutant	Averaging Period	Assessment Objectives	Source
Dust deposition	Monthly	120 mg/m ² /day	EA condition B4(a) ⁽¹⁾
TSP	Annual	90 µg/m ³	QLD Environmental Protection (Air) Policy
PM_{10}	24 hour	50 µg/m ³	EA condition B4(b) ⁽¹⁾
	Annual	25 µg/m ³	QLD EPP (Air)
$PM_{2.5}$	24 hour	20 µg/m ³	QLD EPP (Air)
	Annual	7 µg/m ³	QLD EPP (Air)

Note: (1): Monitoring required when triggered by EA Condition A11.

Dispersion Modelling

Two mining scenarios for the Project based on Business as Usual (BAU) dust management practices were assessed:

- *Project Without (BAU) Case: The mining of DNM as permitted under current mining approvals; and*
- *Project With (BAU) Case: The mining of DNM that includes the Project.*

Dust dispersion modelling was undertaken using the CALMET/CALPUFF suite of modelling tools.

Aligned with worst-case background dust conditions, hourly varying meteorology was developed for 2019 during which time the Project study area was experiencing severe drought conditions.

Background estimates were developed which included both constant values and daily varying concentrations depending on the pollutant and averaging period.

Summary of Results

Incremental changes in air quality outcomes that are attributed to the Project were calculated as the difference in the results for the Project With (BAU) Case compared with those of the Project Without (BAU) Case over the life of the mine (LoM).

Results from the assessment suggest that air quality impacts attributable to the Project are immaterial, with slight improvements in air quality outcomes suggested as a result of the reduced number of VKT associated with the out-of-pit dump, off-setting the slight increase in the overall disturbance area due to the Project.

Results for the Project are summarised in Table B and Table C for the three assessment locations indicated in (Figure A).

Figure A: Assessment Locations



Table B: Changes in Predicted Air Quality Outcomes Attributed to the Project

Receptor	Dust Deposition Monthly Average (mg/m ² /day)	TSP Annual Average (µg/m ³)	PM ₁₀ 24hr Average (µg/m ³)	PM ₁₀ Annual Average (µg/m ³)	PM _{2.5} 24hr Average (µg/m ³)	PM _{2.5} Annual Average (µg/m ³)
	Change in Average of Maximum over LoM	Change in Annual Average over LoM	Change in Average of Maximum over LoM	Change in Annual Average over LoM	Change in Average of Maximum over LoM	Change in Annual Average over LoM
Mine years assessed	15	15	15	15	15	15
R1*	-0.3	-0.8	0.0	-0.1	-0.6	0.0
R2	0.0	-0.1	-0.3	0.0	-0.2	0.0
R3	0.0	0.0	-0.4	0.0	+0.1	0.0

Note *: Impacts to R1 are expected to be managed through a non-residency agreement which WHC are currently negotiating with the landowner.

Table C: Changes in Predicted Exceedances Attributed to the Project

Location	Dust Deposition Exceedance Months	TSP Annual Average Exceedance years	PM ₁₀ 24hr Average Exceedance days	PM ₁₀ Annual Average Exceedance years	PM _{2.5} 24hr Average Exceedance days	PM _{2.5} Annual Average Exceedance years
	Change in Average over LoM	Change in Average over LoM	Change in Average over LoM	Change in Average over LoM	Change in Average over LoM	Change in Average over LoM
Mine years assessed	15	15	15	15	15	15
R1*	-0.1	0.0	-0.6	0.0	+0.1	0.0
R2	0.0	0.0	-0.2	0.0	0.0	0.0
R3	0.0	0.0	-0.3	0.0	-0.1	0.0

Note *: Impacts to R1 are expected to be managed through a non-residency agreement which WHC are currently negotiating with the landowner.

Conclusions

The findings of the air quality assessment suggest that air quality impacts attributable to the Project are immaterial with the increase in wind generated dust associated with the OOPD

disturbance footprint, off-set by the reduction in emissions associated with the short hauling of waste to the OOPD.

No changes to current EA conditions are suggested based on the scale of impacts associated with the Project.

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Abbreviations

AED	Advanced Environmental Dynamics Pty Ltd
BAU	Business As Usual
BoM	Bureau of Meteorology
c.	Circa (approximately)
CALMET	California Meteorological Model
CALPUFF	California Plume Dispersion Model
CHPP	Coal handling and processing plant
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DETSI	Department of the Environment, Tourism, Science and Innovation
DNM	Daunia Mine
DWIP	Daunia West Infrastructure Project
EA	Environmental Authority
EETM	Emission Estimation Technique Manuals
EF	Emission Factor
EPA	Environmental Protection Authority
EPP(Air)	Environmental Protection (Air) Policy
ETA	Electronic Transactions Act
FY	Financial year
GMT	Greenwich Mean Time
Lat	Latitude
LoM	Life of mine
Lon	Longitude
MIA	Mine industrial area
ML	Mine Lease
NASA	National Aeronautics and Space Administration
NPI	National Pollutant Inventory
OOPD	Out Of Pit Dump
PM ₁₀	Particulate matter with an aerodynamic diameter less than 10 microns
PM _{2.5}	Particulate matter with an aerodynamic diameter less than 2.5 microns

Abbreviations (continued)

QLD	Queensland
RoM	Run-of-mine
SRTM	Shuttle Radar Topography Mission
TAPM	The Air Pollution Model
TSP	Total suspended particulates
UTC	Coordinated Universal Time
UTM	Universal Transverse Mercator
VKT	Vehicle Kilometres Travelled
WHC	Whitehaven Daunia Pty Ltd



Units

%	per cent
°C	degrees Celsius
g/cm ³	grams per cubic centimetre
h	hour
kg/h	kilograms per hour
kg/tonne	kilograms per tonne
kg/VKT	kilograms per Vehicle Kilometres Travelled
km	kilometres
m	metre
m ²	square metre
mg/m ² /day	Milligrams per square metre per day
mm	millimetre
m/s	Metres per second
Mtpa	Million tonnes per annum
t/year	tonne per year
µg	micrograms
µg/m ³	micrograms per cubic metre

1. Introduction

Advanced Environmental Dynamics Pty Ltd (AED) was commissioned by SLR Consulting Australia Pty Ltd on behalf of Whitehaven Daunia Pty Ltd (WHC) to undertake an air quality assessment of Daunia Mine's (DNM) West Infrastructure Project (DWIP).

This report contains a summary of the assessment methodology and findings.

Additional detail can be found in the supporting appendices.

2. Project Summary

DNM is located approximately 25 kilometres southeast of Moranbah in Central Queensland on Mining Leases (ML) 1781, ML70115 and ML70116. DNM operates under Environmental Authority (EA) EPML00561913, granted under the Environmental Protection Act 1994 (QLD) (EP Act). DNM produces up to 6.1 million tonnes per annum (Mtpa) of Run-of-Mine (RoM) coal and has a production capacity of 4.9 Mtpa of product metallurgical coal. DNM is approved for a 30 year mine plan and is scheduled to end in FY2041.

WHC is proposing to construct and operate a 282 ha (maximum 250 m high) out-of-pit-dump (OOPD), with associated infrastructure including hauls roads and dams (the Project). The disturbance footprint for the Project totals to approximately 305 ha.

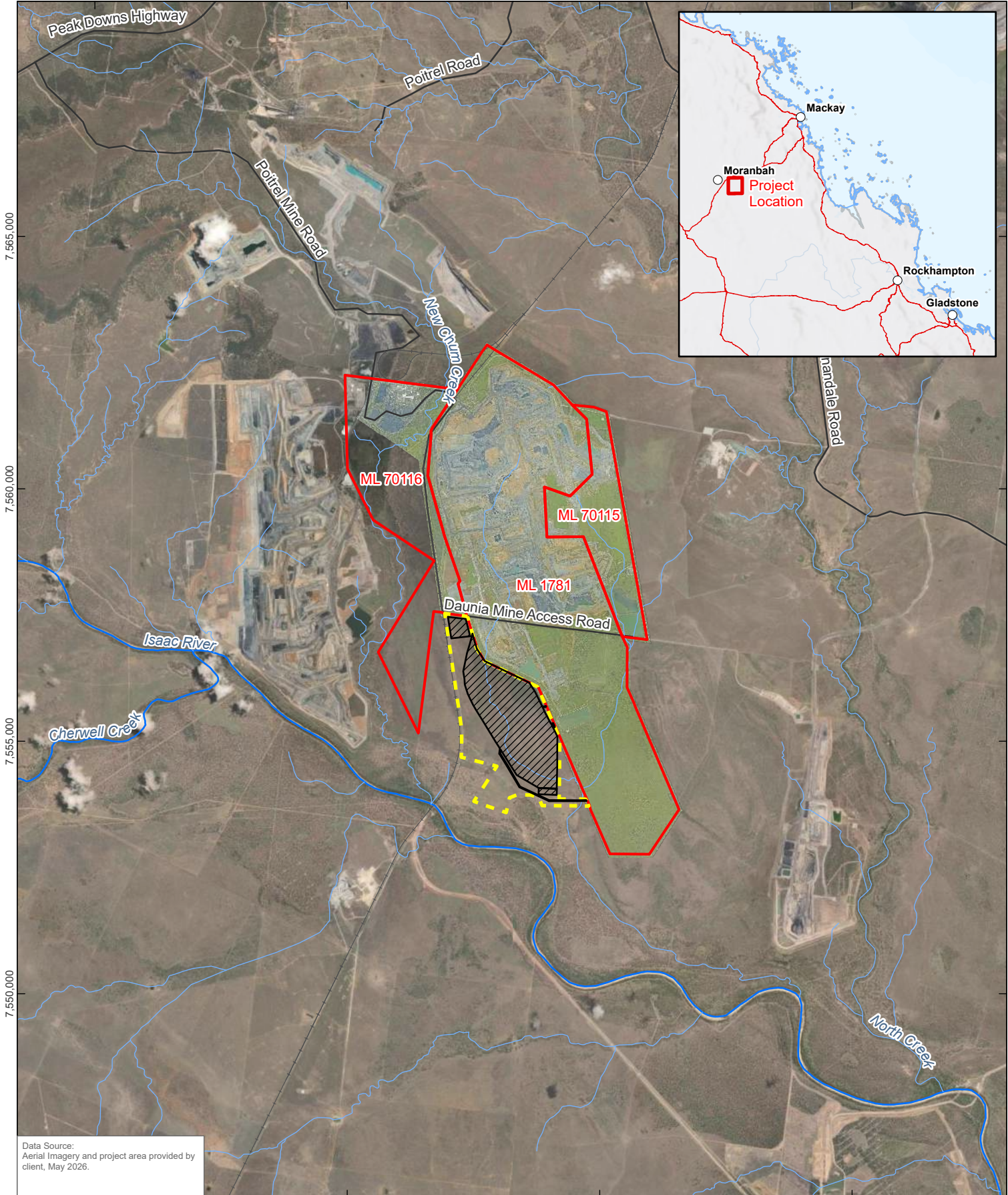
The key elements of the Project that are relevant to the air quality assessment include: vegetation clearing, the formalisation of access tracks and haul roads, and the rehabilitation of the OOPD.

625,000


630,000








635,000

640,000



Data Source:
Aerial Imagery and project area provided by
client, May 2026.

 0 1 2 km
 Coordinate System: GDA2020 MGA Zone 55
 Scale: 1:100,000 at A4
 Project Number: 620.042120.00001
 Date Drawn: 14-May-2026
 Drawn by: RB

- LEGEND**
-  Road
 -  Railway
 -  Major Watercourse
 -  Minor Watercourse
 -  Mining Lease
 -  Mining Lease Application Area / Project Area
 -  Disturbance Footprint

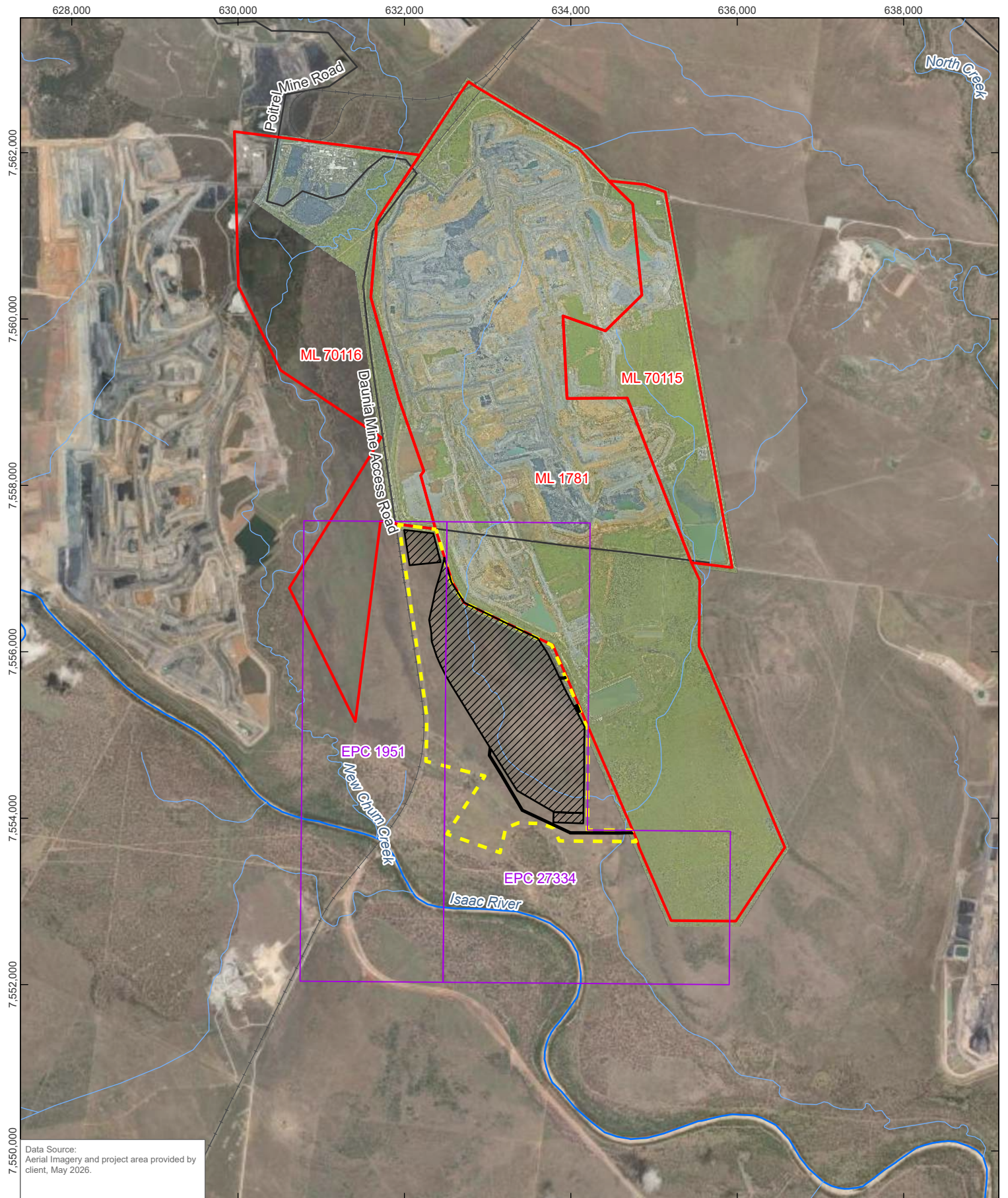
**DAUNIA WEST
INFRASTRUCTURE PROJECT**

SITE LOCATION



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FIGURE 1



Data Source:
Aerial Imagery and project area provided by
client, May 2026.



Coordinate System: GDA2020 MGA Zone 55
Scale: 1:60,000 at A4
Project Number: 620.042120.00001
Date Drawn: 14-May-2026
Drawn by: RB

- LEGEND**
- Road
 - +— Railway
 - Major Watercourse
 - Minor Watercourse
 - ▭ Mining Lease
 - ▭ Mining Lease Application Area / Project Area
 - ▨ Disturbance Footprint
 - ▭ Exploration Permit for Coal

**DAUNIA WEST
INFRASTRUCTURE PROJECT**

PROJECT OVERVIEW



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FIGURE 2

2.1 Environmental Authority Conditions

DNM operates under Environmental Authority (EA) (Permit Number EPML00561913). In relation to dust, EA Condition A11, Condition B3 and Condition B4 are of particular interest to this assessment:

A11	<p>Monitoring on request</p> <p>When requested by the administering authority, the environmental authority holder must investigate any nuisance, or contaminant release, or environmental harm, or complaint that is neither frivolous nor vexatious in the opinion of the authorised person, by:</p> <ol style="list-style-type: none"> a) undertaking the monitoring specified by the administering authority; b) undertaking the monitoring in the timeframe nominated or agreed to by the administering authority; c) completing an analysis and interpretation of the monitoring results; and d) implementing abatement measures, where required.
B3	<p>Dust nuisance</p> <p>The release of dust or particulate matter or both resulting from the mining activities must not cause an environmental nuisance, at any sensitive place or commercial place.</p>
B4	<p>Monitoring of dust and particulate matter resulting from the mining activities, undertaken in accordance with condition A11, must be carried out at a place relevant to the potentially affected sensitive place or commercial place and must not exceed the following levels when measured at any sensitive place or commercial place:</p> <ol style="list-style-type: none"> a) dust deposition, measured as total insoluble matter, of 120 milligrams per square metre per day, averaged over one month, when monitored in accordance with the most recent version of Australian Standard <i>AS3580.10.1 Methods for sampling and analysis of ambient air – Determination of particulate matter – Deposited matter – Gravimetric method</i>. b) a concentration of particulate matter with an aerodynamic diameter of less than 10 micrometre (PM10) suspended in the atmosphere of 50 micrograms per cubic metre over a 24-hour averaging time, when monitored in accordance with the most recent version of either: <ol style="list-style-type: none"> i) Australian Standard <i>AS3580.9.6 Methods for sampling and analysis of ambient air – Determination of suspended particulate matter – PM10 high volume sampler with size selective inlet – Gravimetric method</i>, or ii) Australian Standard <i>AS3580.9.8 Methods for sampling and analysis of ambient air – Determination of suspended particulate matter – PM10 continuous direct mass method using a tapered element oscillating microbalance analyser</i>, or iii) Australian Standard <i>AS3580.9.9 Methods for sampling and analysis of ambient air – Determination of suspended particulate matter – PM10 low volume sampler – Gravimetric method</i>, or iv) Australian Standard <i>AS3580.9.11 Methods for sampling and analysis of ambient air – Determination of suspended particulate matter – PM10 beta attenuation monitors</i>. <p><small>NOTE: Exceedances due to events that cannot be managed by the environmental authority holder, such as bushfires, fuel reduction burning for fire management purposes or dust storms, would not be considered to be in breach of condition B4 if the environmental authority holder can demonstrate that the exceedance was caused by such events.</small></p>

AED understands that to date, operations have not received a request from the administering authority (Condition A11) to assess the mine's performance against the air quality objectives specified in *Schedule B Condition B4* for the monthly average deposition of dust nor the 24

hour average concentration of particulate matter with an aerodynamic diameter less than 10 microns (PM₁₀) (Table 1).

Table 1: DNM Environmental Authority Air Quality Objectives

Pollutant	Averaging Period	EA Objectives	Source
Dust deposition	Monthly	120 mg/m ² /day	EA Condition B4(a) ⁽¹⁾
PM ₁₀	24 hour	50 µg/m ³	EA Condition B4(b) ⁽¹⁾

Note (1): Exceedances due to events that cannot be managed by the environmental authority holder, such as bush fires, fuel reduction burning for fire management purposes or dust storms, would not be considered to be in breach of condition B4 if the environmental authority holder can demonstrate that the exceedance was caused by such events.

2.1.1 Summary of Air Quality Assessment Objectives

Pollutants considered in this assessment have been expanded to include: the annual average concentration of total suspended particulates (TSP), the annual average concentration of PM₁₀ as well as the 24 hour average and annual average concentration of particulate matter with an aerodynamic diameter less than 2.5 microns (PM_{2.5}). Due to the primarily mechanical means by which dust is generated by open cut mining activities, PM_{2.5} is not typically generated in significant amounts by open cut mining but is instead associated with combustion processes. Nonetheless, an assessment of PM_{2.5} has been undertaken for completeness.

Table 2: Summary of Air Quality Assessment Objectives

Pollutant	Averaging Period	Assessment Objectives	Source
Dust deposition	Monthly	120 mg/m ² /day	DNM EA condition B4(a)
TSP	Annual	90 µg/m ³	QLD Environmental Protection (Air) Policy
PM ₁₀	24 hour	50 µg/m ³	DNM EA condition B4(b)
	Annual	25 µg/m ³	QLD Environmental Protection (Air) Policy
PM _{2.5}	24 hour	20 µg/m ³	QLD Environmental Protection (Air) Policy
	Annual	7 µg/m ³	QLD Environmental Protection (Air) Policy

2.2 Assessment Locations

The DNM EA defines a sensitive place as:

Sensitive place means;

- a) Any of the following:
 - i. A dwelling, residential allotment, mobile home or caravan park, residential marina or other residential premises; or
 - ii. A motel, hotel or hostel; or
 - iii. A medical centre or hospital; or
 - iv. A protected area; or
 - v. A public park or gardens.
- b) Despite paragraph (a), the following places are not sensitive places:
 - i. subject to paragraph (c), a place that is the subject of an alternative arrangement; or
 - ii. a mining camp (i.e. accommodation and ancillary facilities for mine employees or contractors or both, associated with the mine the subject of the environmental authority), whether or not the mining camp is located within a mining tenement that is part of the mining project the subject of the environmental authority. For example, the mining camp might be located on the neighbouring land owned or leased by the same company as one of the environmental authority holders for the mining project or related company; or
 - iii. a property owned or leased by one or more of the environmental authority holder, or a related company whether or not is subject to an alternative arrangement.
- c) A place that is the subject of a current alternative arrangement in relation to a particular type(s) of environmental nuisance, is not a sensitive place for the purpose of that type(s) of environmental nuisance, however, remains a sensitive place for the purposes of other types of environmental nuisances.

The DNM EA also defines:

Commercial place means:

- a) A work place that is used as:
 - i. An office; or
 - ii. A place of business; or

- iii. A place used for commercial purposes.
- b) Despite paragraph (a). the following places are not commercial places:
 - i. Subject to paragraph (c), a place that is the subject of an alternative arrangement; or
 - ii. Places that are part of the mining activity; or
 - iii. Employee accommodation or public roads; or
 - iv. A property owned or leased by one or more of the environmental authority holders, or a related company whether or not is subject to an alternative arrangement
- c) A place that is the subject of a current alternative arrangement in relation to a particular type(s) of environmental nuisance, is not a sensitive place for the purpose of that type(s) of environmental nuisance, however remains a sensitive place for the purposes of other types of environmental nuisances.

In consideration of the above definitions and locations specified in the DNM, a summary of the air quality assessment locations is provided in Table 3 and are depicted in Figure 3.

Regarding the Olive Downs Homestead (R1), whilst this location is currently a sensitive receptor under the DNM EA, WHC are currently negotiating with the landowner to establish a non-residency agreement, thereby removing R1 as a “Sensitive Place”.

Table 3: Receptor Locations

ID	Easting (m) ⁽¹⁾	Northing (m) ⁽¹⁾	Description
R1	633,911	7,553,020	Olive Downs Homestead ⁽²⁾
R2	639,658	7,558,572	Daunia Homestead
R3	639,052	7,563,796	Mavis Downs Homestead

Note: (1) Based on GDA 2020 MGA Zone 55 coordinate reference.

(2) Impacts to the Olive Downs Homestead are expected to be managed through a non-residency agreement which WHC are currently negotiating with the landowner.

Figure 3: Project area and Assessment Locations



3. Existing Air Quality Environment

The quantification of air quality throughout the local airshed is complicated as it is the result of a combination of natural and anthropogenic dust emission sources, the impacts from which are both temporally and spatially varying.

Adding to the complexity of the interpretation of current dust levels within the regional air shed is the existence of both WHC owned/operated (i.e. Daunia Mine) and non-WHC owned/operated (i.e. Poitrel Mine, Millennium Mine, Moorvale Mine, Moorvale South Mine, Moorvale South to Moorvale Mine haul road, Daunia quarry, Peak Downs Mine) significant, dust emission sources (Figure 3).

In theory, background levels of pollutants are the concentrations that would occur in the absence of anthropogenic emission sources. In practice, the practicalities and limitations associated with the establishment of ambient air monitoring stations means that they are rarely sited at locations which are not influenced to some degree by anthropogenic emission sources.

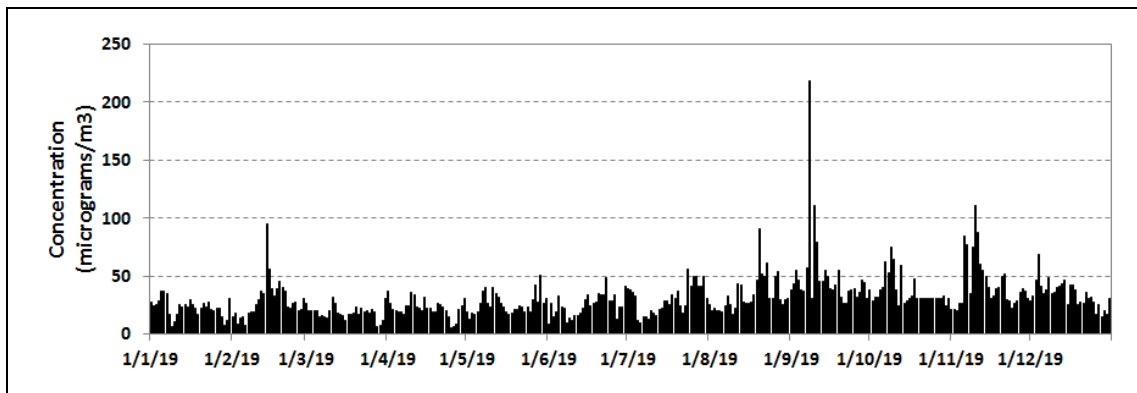
Estimating background levels is further complicated by the fact that, although the Victorian EPA recommend the use of the 70th percentile as an estimate for the background level, in reality background levels will be spatially and temporally varying as the emission rate of pollutants from natural sources are often functions of a number of factors including for example, frequency of rain, wind speed, atmospheric stability etc.

These limitations noted however, for the purposes of this assessment, dust deposition data from R1 (Figure 3) has been used to estimate background levels.

For the purposes of estimating background levels of PM₁₀, hourly averaged data from the DETSI Moranbah (Utah Drive) monitoring station has been used to generate a daily varying timeseries for the 24 hour average concentration of PM₁₀ for 2019 (Figure 4) at which time the region was under significant drought conditions The hourly average data set was also used to generate an estimate for the annual average concentration of PM₁₀.

An estimate for the annual average concentration of TSP has been developed based on an assumption that 50% of TSP is in the form of PM₁₀.

Figure 4: Daily varying 24 Hour Average Concentration of PM₁₀ (DETSI Moranbah (Utah Drive), 2019)



Estimates of background levels of PM_{2.5} were based on data from the DETSI Moranbah (Utah Drive) monitoring station. In the absence of a complete data set for 2019, the estimates of background levels of PM_{2.5} are based on data from the period 10/10/2019 through 30/09/2020. An estimate for the 24 hour average concentration of PM_{2.5} is based on the 70th percentile of the data set. The average of the data set has been used as the estimate for the annual average concentration of PM_{2.5}.

The estimate developed for the background level of dust deposition is based on an average of data from the DNM dust deposition monitoring location situated in the vicinity of R1 (Figure 3) for the period March 2015 through February 2024.

Estimates of background levels are summarised in Table 4.

Table 4: Estimate of Background Levels

Pollutant	Averaging Period	Estimated Background Level	Percentage of Assessment Objectives	Source
Dust deposition	Monthly	38 mg/m ² /day	c. 32%	DNM DDG Data ⁽¹⁾
TSP	annual	62.2 µg/m ³	c. 69%	Inferred from DETSI Moranbah (Utah Drive) ⁽³⁾
PM ₁₀	24 hour	Daily varying	n/a	DETSI Moranbah (Utah Drive) ⁽²⁾
	annual	31.1 µg/m ³	c. 125% ⁽⁵⁾	DETSI Moranbah (Utah Drive) ⁽²⁾
PM _{2.5}	24 hour	7.2 µg/m ³	c. 29%	DETSI Moranbah (Utah Drive) ⁽⁴⁾
	annual	7.4 µg/m ³	c. 106%	DETSI Moranbah (Utah Drive) ⁽⁴⁾

Note: (1) Data collected over the period 03/2015 through 02/2024 has been used.

(2) Data collected over the period 01/2019 to 12/2019 has been used.

(3) Based on an assumption that 50% of TSP is in the form of PM₁₀.

(4) Data collected over the period 10/10/2019 to 30/09/2020 has been used.

(5) Values in bold font exceed the relevant Project assessment objective.

4. Overview of Assessment Methodology

4.1 Dust Emission Sources

A number of dust generating activities are associated with mining operations at DNM:

- Topsoil stripping
- Drilling and blasting of both overburden and coal
- Truck loading and dumping and shovel operations both overburden and coal
- Wheel generated dust from coal hauling to CHPP
- Wheel generated dust from transport of overburden to dumps
- Dozers operating on coal and waste material
- Rejects hauling
- Stacking and reclaiming at raw coal stockpiles
- Stacking and reclaiming at product stockpiles
- Wind erosion from exposed areas including overburden dumps

- Wind erosion from coal stockpiles
- CHPP activities

Dust emission sources that have been explicitly modelled include (and are limited to):

- Coal mining, hauling and dumping
- Waste removal by Truck and Shovel fleets including the loading of trucks, hauling and truck dumping
- Dozer operations in support of in-pit coal operations
- Dozer operations in support of waste handling
- CHPP activities (crushing, stacking, reclaiming)
- Wind erosion of exposed areas.

The incorporated dust emission sources are considered to represent the majority of significant site-based dust generating emissions sources with those excluded considered to be immaterial.

4.2 Dust Emission Scenarios

Two mining scenarios for the Project based on Business as Usual (BAU) dust management practices have been assessed:

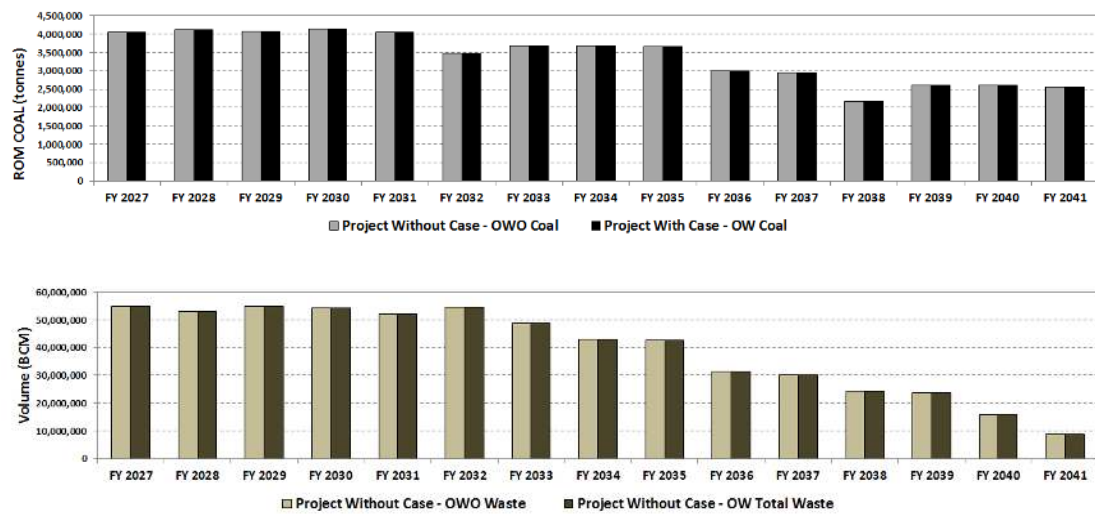
- Project Without (BAU) Case: The mining of DNM as permitted under current mining approvals; and
- Project With (BAU) Case: The mining of DNM including the Project.

As indicated in Figure 5, the annual ROM coal tonnages and overburden waste volumes are the same for both of the mining scenarios modelled, for each year assessed. This highlights that the Project will have no material impact on the amount of coal mined or the volume of waste that is required to be moved. Instead, the proposed OOPD (i.e. Project) provides an option for the short hauling of waste to a closer waste disposal location (i.e. Project With Case) than would be available in the absence of the OOPD (i.e. Project Without Case).

Although the life of the OOPD is estimated at approximately 7 years (including rehab), the impact in terms of the sequencing of mining operations will extend throughout the life of the mine which is approximately 15 years. Thus the impact of the Project in relation to changes in air quality outcomes is considered over the life of the mine (LoM, i.e. c. 15 years) as opposed to solely considering the life of the Project (i.e. c. 7 years).

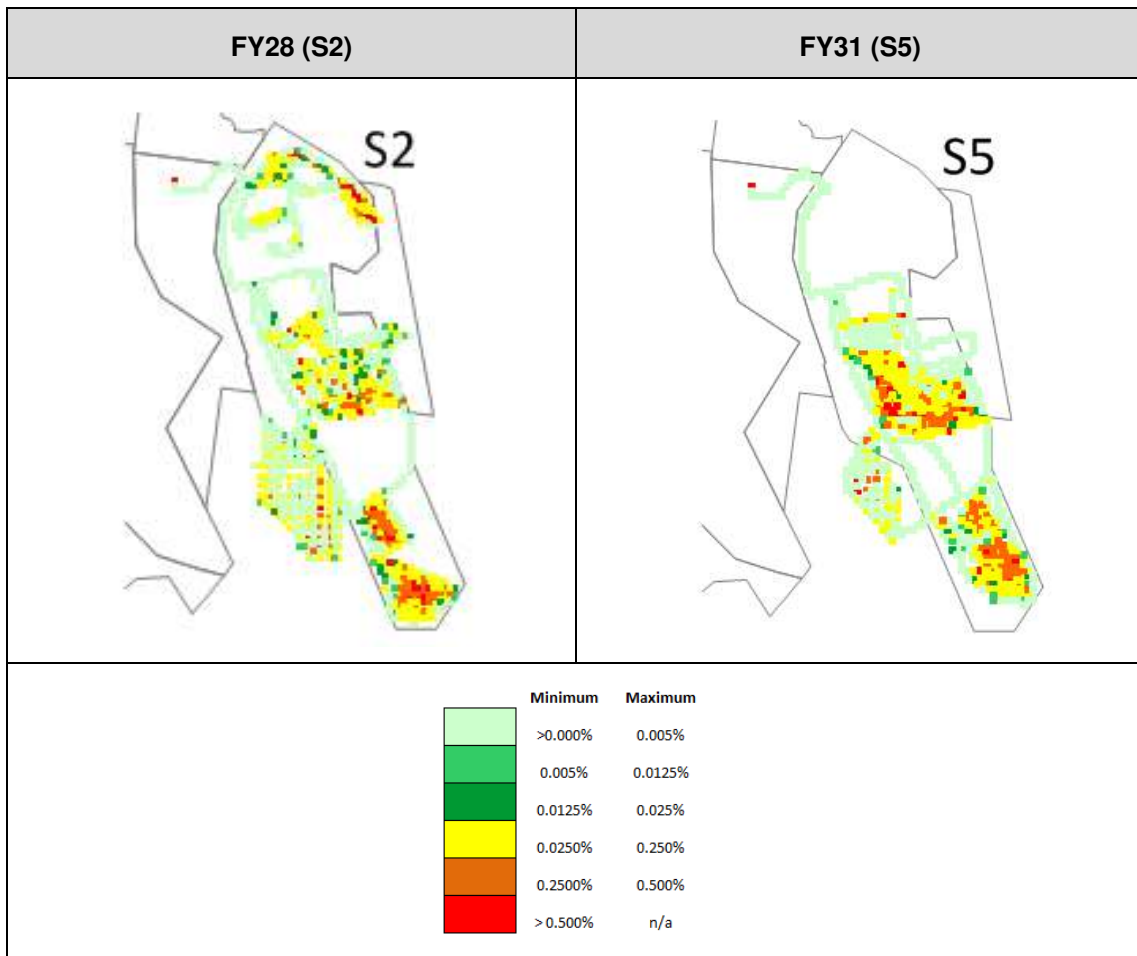
Detailed mine planning and haulage model output was provided by WHC for both of the Project cases assessed. Output from the mine planning model includes details of the sequencing of material handling activities for each year of the life of the mine. Output from the haulage model includes details of the coal and waste haul routes for each year of the life of mine. AED uses proprietary software tools to interpret and develop the temporally and spatially varying emissions inventories for which an example is provided in Figure 6.

Figure 5: ROM Coal Tonnages and Waste Volumes (BCM) for Both Mine Cases (LoM)



An example of dust emission source locations associated with waste handling by truck and shovel, coaling and dozer activities for the Project With (BAU) case are provided in Figure 6. Results are presented as a percentage of the annual total emissions associated with these activities highlighting the spatial variability in mining intensity.

Figure 6: Project With (BAU) Case: PM₁₀ Emissions Intensity as Percentage of Annual Total based on Truck & Shovel, Coaling and Dozer Activities



4.3 Dust Reduction Measures

DNM dust reduction measures that have been incorporated into the dust dispersion modelling include: the use of water sprays at the RoM dump, the use of water sprays whilst crushing and the watering of haul roads at a rate of more than 2 litres/m²/hour (i.e. level 2 watering)

4.4 Dust Emissions Inventory

The National Pollutant Inventory (NPI) has produced a series of Emission Estimation Technique Manuals (EETM) that are intended to provide data on emissions of air pollutants from a wide variety of industries/activities. For this assessment, the NPI EETM for Mining V3.1 (NPI, 2012) has been used to develop estimates of the amount of TSP and PM₁₀ emitted from the various dust generating activities and incorporating site-specific information where

available. Emission factors from the NPI EETM for Mining were supplemented with those from the US EPA's AP42 (USEPA, 1995) as required and/or considered appropriate. Additionally, it has been conservatively assumed that 20% of PM₁₀ is in the form of PM_{2.5}.

Details of the development of the emission factors used in this assessment are provided in Appendix C.

Details of the emissions inventories for the Project With (BAU) case and the Project Without (BAU) case are presented in Appendix D.

Dust emissions associated with the Project are calculated as the difference between those for the Project With (BAU) case minus those for the Project Without (BAU) case. Results for two specific years of mining (FY28 and FY31) corresponding to high activity periods within the proposed OOPD, are summarised in Table 5.

Emission estimates presented in the table highlight the increase in emissions associated with the OOPD disturbance footprint as well as the decrease in emissions associated with the reduction in VKT associated with the short hauling of waste to the OOPD. A net overall reduction in dust emissions is estimated to be associated with the Project, with the advantages of short hauling outweighing the disadvantage of the larger disturbance footprint.

Table 5: The Project's Emission Inventory

Activity	TSP (t/year)		PM10 (t/year)		PM2.5 (t/year)	
	FY28	FY31	FY28	FY31	FY28	FY31
Coal handling	0	0	0	0	0	0
Waste handling by truck & shovel	-860	-390	-321	-145	-74	-29
Dozers	0	0	0	0	0	0
CHPP	0	0	0	0	0	0
Wind erosion (disturbance)	124	43	62	22	12	4
Total	-736	-346	-258	-124	-51	-25

4.5 Dispersion Modelling Methodology

Three-dimensional wind fields used as input into the dispersion model were prepared using a combination of The Air Pollution Model (TAPM) developed by the Commonwealth Scientific and Industrial Research Organisation (CSIRO) (Hurley, 2008), and CALMET, the meteorological pre-cursor for CALPUFF (Scirer, 2000).

Aligning with worst-case background dust conditions, hourly varying meteorology was developed corresponding to 2019.

Dust dispersion modelling was undertaken using CALPUFF. Examples of the locations of dust emission sources incorporated into the dispersion modelling were indicated in Figure 6.

Details of the model set up are provided in Appendix B.

5. Summary of the Results from the Dispersion Modelling

A summary of the results from the dispersion modelling for the Project are presented in this section. Detailed results for the Project With (BAU) case and Project Without (BAU) case are provided in Appendix E.

Dust impacts attributed to the Project are calculated as those for the Project With (BAU) case minus those for the Project (BAU) Without case.

Presented in Table 6 is a summary of the changes to air quality outcomes attributable to the Project for each of the dust pollutants of interest at each of the three assessment locations.

Included in the table are the impacts attributed to the Project for each of the following which are presented as an average over the LoM (i.e. as an average over the 15 years assessed):

- The change in the maximum monthly average dust deposition
- The change in the annual average concentration of TSP
- The change in the maximum 24 hour average concentration of PM₁₀
- The change in the annual average concentration of PM₁₀
- The change in the maximum 24 hour average concentration of PM_{2.5}
- The change in the annual average concentration of PM_{2.5}

Presented in Table 7 is a summary of the changes in the predicted number of exceedances that are attributed to the Project, for each of the pollutants and averaging periods assessed.

Results presented in the tables highlight the immateriality of the Project with changes in air quality outcomes attributed to the Project, predicted to be less than $\pm 1 \text{ mg/m}^2/\text{day}$ or less than $\pm 1 \text{ }\mu\text{g/m}^3$ at all locations for all pollutants and averaging periods assessed.

Table 6: Changes in Predicted Air Quality Outcomes Attributed to the Project

Location	Dust Deposition Monthly Average (mg/m ² /day)	TSP Annual Average (µg/m ³)	PM ₁₀ 24hr Average (µg/m ³)	PM ₁₀ Annual Average (µg/m ³)	PM _{2.5} 24hr Average (µg/m ³)	PM _{2.5} Annual Average (µg/m ³)
	Change in Average of Maximum over LoM	Change in Annual Average over LoM	Change in Average of Maximum over LoM	Change in Annual Average over LoM	Change in Average of Maximum over LoM	Change in Annual Average over LoM
Mine years assessed	15	15	15	15	15	15
R1*	-0.3	-0.8	0.0	-0.1	-0.6	0.0
R2	0.0	-0.1	-0.3	0.0	-0.2	0.0
R3	0.0	0.0	-0.4	0.0	+0.1	0.0

Note *: Impacts to the Olive Downs Homestead are expected to be managed through a non-residency agreement which WHC are currently negotiating with the landowner.

Table 7: Changes in Predicted Exceedances Attributed to the Project

Location	Dust Deposition Exceedance Months	TSP Annual Average Exceedance years	PM ₁₀ 24hr Average Exceedance days	PM ₁₀ Annual Average Exceedance years	PM _{2.5} 24hr Average Exceedance days	PM _{2.5} Annual Average Exceedance years
	Change in Average over LoM	Change in Average over LoM	Change in Average over LoM	Change in Average over LoM	Change in Average over LoM	Change in Average over LoM
Mine years assessed	15	15	15	15	15	15
R1*	0.0	0.0	-0.6	0.0	+0.1	0.0
R2	0.0	0.0	-0.2	0.0	0.0	0.0
R3	0.0	0.0	-0.3	0.0	-0.1	0.0

Note *: Impacts to the Olive Downs Homestead are expected to be managed through a non-residency agreement which WHC are currently negotiating with the landowner.

6. Conclusion

AED has undertaken an air quality assessment of the Daunia West Infrastructure Project. The Project involves the construction and operation of an out-of-pit dump (OOPD) to the west of, and adjacent to, ML1781, off-lease from DNM.

The Project permits the disposing of waste material to a location closer to the source of the material when compared to the disposing of the waste material in northern, on-lease areas, thereby reducing the overall vehicle kilometres travelled (VKT) associated with waste handling.

Specifically, two dust emission scenarios for DNM were considered based on Business as Usual (BAU) dust management practices:

- Project Without (BAU) Case: The mining of DNM as permitted under current mining approvals.
- Project With (BAU) Case: The mining of DNM with the inclusion of the Project.

Of particular interest were changes in air quality outcomes at neighbouring locations¹ due to emissions of TSP, PM₁₀, PM_{2.5} and dust deposition. Emission estimates and air quality outcomes attributed to the Project were calculated based on those for the Project With (BAU) case minus those for the Project Without (BAU) case.

The Project's dust emissions inventory highlighted the net reduction in emissions associated with the Project as dust generated by the OOPD disturbance footprint was off-set by the reduction in emissions associated with the short hauling of waste to the OOPD.

The findings of the air quality assessment suggest that air quality impacts attributable to the Project are immaterial in general, with slightly improved outcomes predicted at all of the locations assessed.

No changes to current EA conditions are suggested based on the scale of impacts associated with the Project.

A review of current dust management practices, dust mitigation options and dust management strategies is recommended to be undertaken if a request from the administering authority under EA Condition A11 to assess the mine's performance against Condition B4 air

¹ Regarding the Olive Downs Homestead (R1), whilst this location is currently considered a sensitive receptor under the DNM EA, WHC are currently negotiating with the landowner to establish a non-residency agreement thereby removing R1 as a "Sensitive Place".

quality objectives is received and there is evidence to suggest that current dust management practices are inadequate.

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Appendix A. Meteorological Environment

This appendix describes rainfall patterns, air temperature, humidity, wind speed and direction, as well as stability class characteristics in the region.

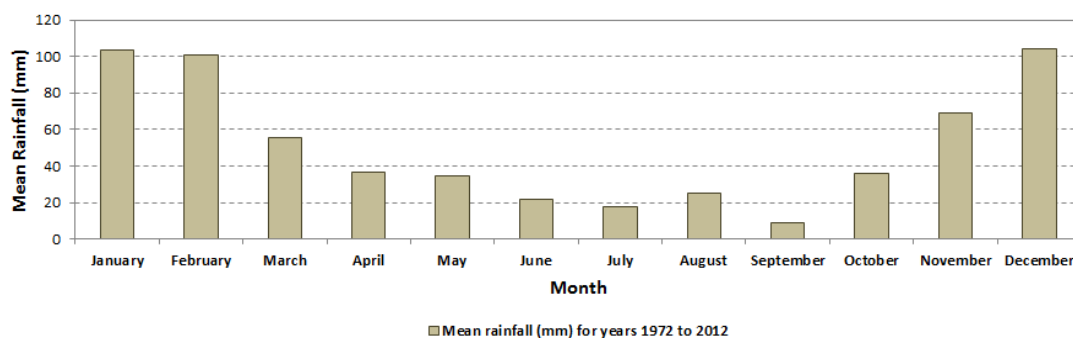
Data for long term climate statistics have been sourced from the Bureau of Meteorology (BoM) climate statistics for the Moranbah Water Treatment Plant. Available climate data ranges from 1972 and ends in April 2012.

BoM data was supplemented by numerically simulated data developed using CALMET to provide site-specific parameters that cannot be directly measured, such as stability class.

Rainfall Patterns

The mean annual rainfall at Moranbah is approximately 600 mm of which c. 50% is received between the months of November through March. Monthly mean rainfall values for the period January 1972 through March 2012 are presented in Figure 7.

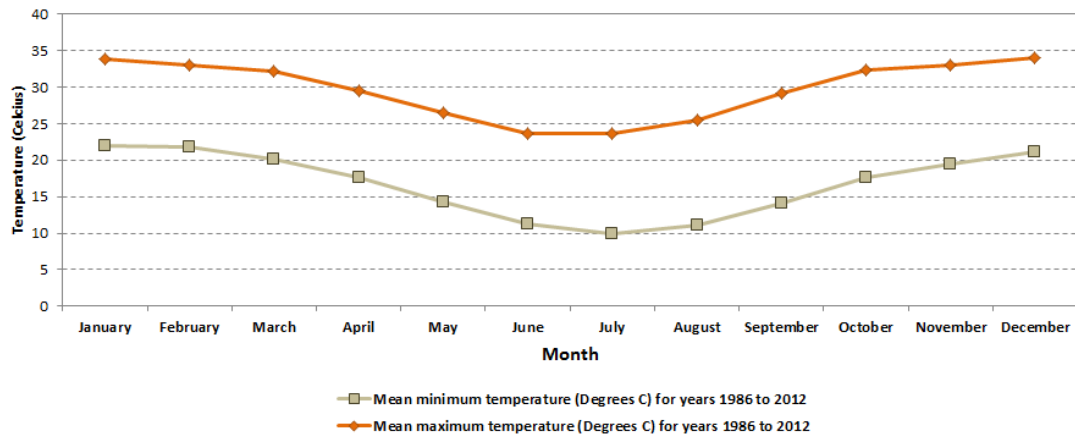
Figure 7: Mean Rainfall Statistics, Moranbah Water Treatment Plant (1972-2012)



Air Temperature

Long term ambient air temperature statistics for the mean maximum and mean minimum from Moranbah Water Treatment Plant suggest that the maximum daily temperatures in summer average between 33.1°C and 34°C, with overnight minimums averaging between 21.1°C and 21.9°C. During winter, the maximum daily temperatures average between 23.7°C and 25.5°C, with overnight minimums averaging between 9.9°C and 11.2°C (Figure 21).

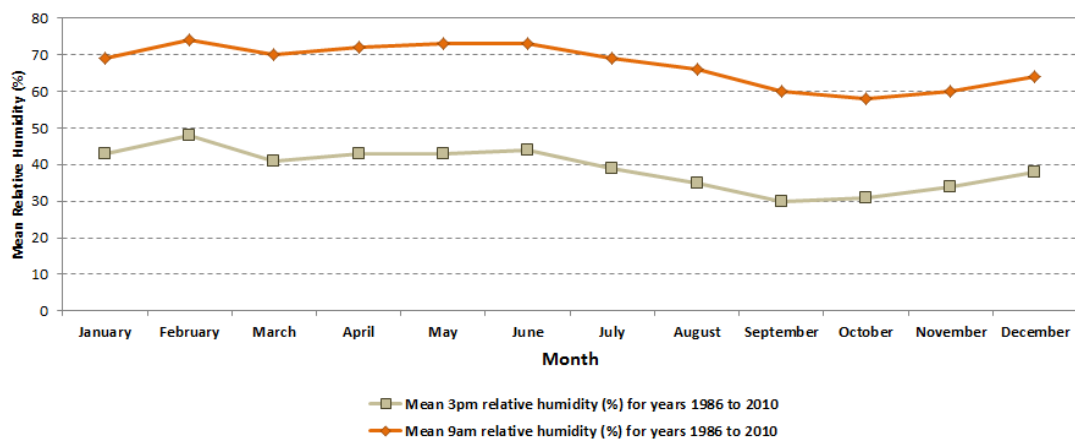
Figure 8: Mean Air Temperature Statistics, Moranbah Water Treatment Plant (1986-2012)



Humidity

The mean relative humidity measured at 9am and 3pm at the Moranbah Water Treatment Plant are presented in Figure 9. The mean monthly relative humidity at 9am ranges from 58% (in October) to 74% (in February). Records of mean relative humidity at 3pm indicate that humidity is lowest in September (30%) and highest in February (48%).

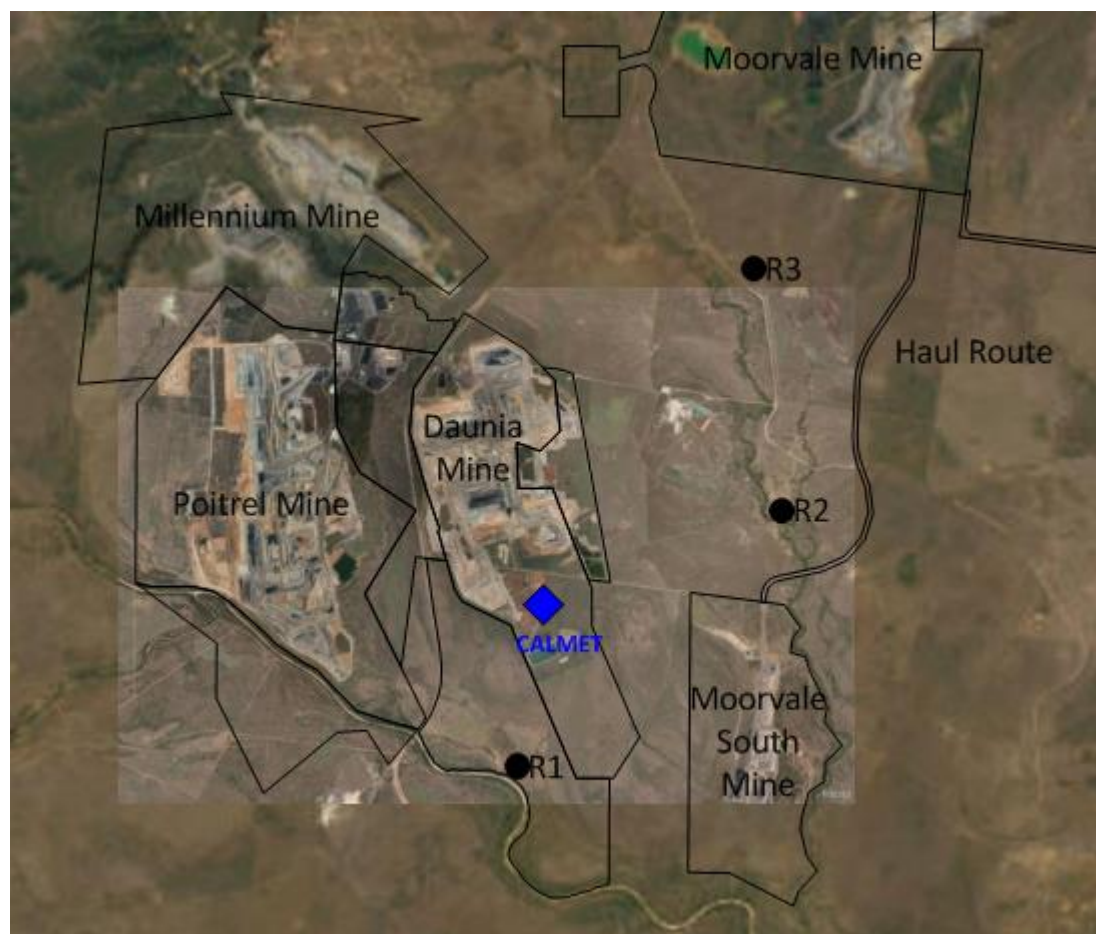
Figure 9: Mean Relative Humidity Statistics, Moranbah Water Treatment Plant (1986-2010)



Wind Speed and Direction

Numerically simulated wind fields (CALMET) for 2019 were developed. The location of the extracted numerically simulated wind data developed using CALMET is shown in Figure 10.

Figure 10 Location of CALMET Extracted Data



Presented in Figure 11 is a wind rose based on hourly averaged data from the CALMET meteorological model. The wind rose highlights the predominance of easterly through south-easterly winds at this location.

The seasonal variability in the wind speed and direction is highlighted by the wind roses presented in Figure 12. The wind roses provided in Figure 13 highlight the variation in wind conditions as a function of the time of day. Of particular note is the increased frequency of light winds during the night and an increased frequency of elevated winds during the day time hours.

Figure 11: Wind Rose (m/s) for 2019 based on CALMET Hourly Averaged Data

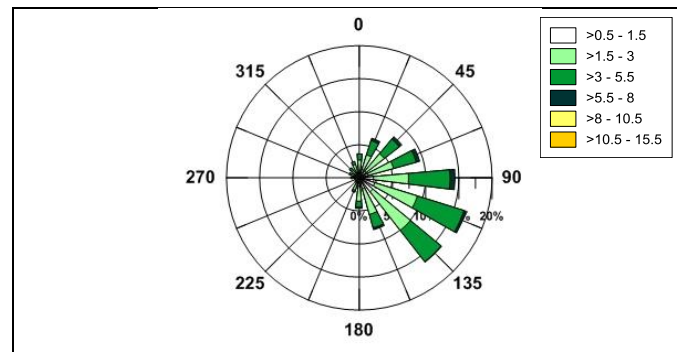
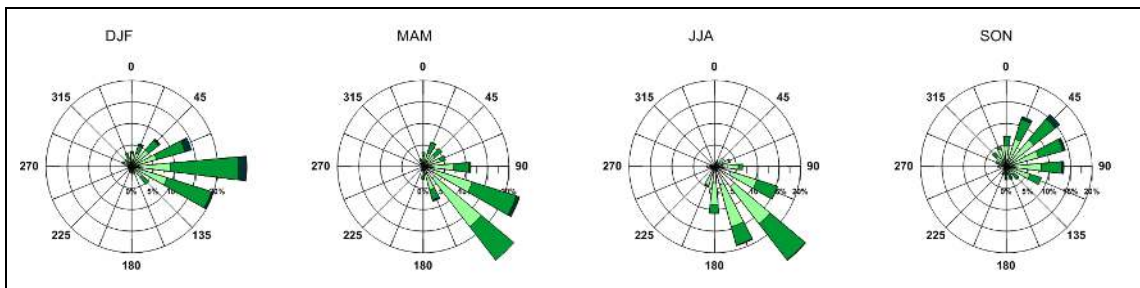
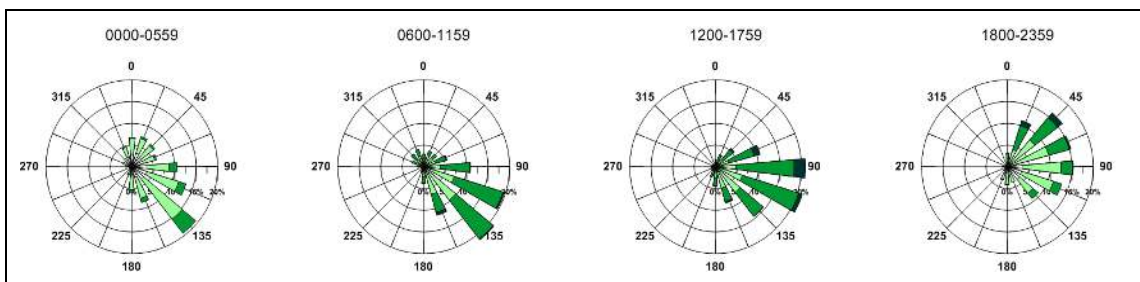


Figure 12: Seasonal Wind Roses (m/s) based on CALMET Hourly Averaged Data (m/s) (2019)



Note: DJF – December, January, February, MAM – March April May, JJA – June, July, August, SON – September, October, November

Figure 13: Hour of Day Wind Roses (m/s) based on CALMET Hourly Averaged Data (m/s) (2019)



Atmospheric Stability

Stability of the atmosphere is determined by a combination of horizontal turbulence caused by the wind and vertical turbulence caused by the solar heating of the ground surface. Stability cannot be measured directly; instead it must be inferred from available data, either measured or numerically simulated.

The Pasquill-Gifford scale defines stability on a scale from A to G, with stability class A being the least stable, occurring during strong daytime sun and stability class G being the most stable condition, occurring during low wind speeds at night. For any given wind speed the stability category may be characterised by two or three categories depending on the time of day and the amount of cloud present. In meteorological models such as CALMET, the stability classes F and G are combined.

A summary of the numerically simulated hourly stability class data for CALMET (2019) is presented in Figure 14 and Figure 15. Stability class D is predicted to occur most frequently (38.8%). Stability Class D are neutral conditions that typically occur during moderate wind speeds with little or no solar radiation (night time or cloudy periods).

Stability class F conditions are predicted to occur second most frequently (29.4%) indicating that a high percentage of conditions are moderately to very stable, with very little lateral and vertical diffusion.

The frequency of strongly convective (unstable) conditions at the study area, represented by stability class A, is relatively low at less than 2% of hours.

Figure 14: Frequency of Stability Class (CALMET 2019)

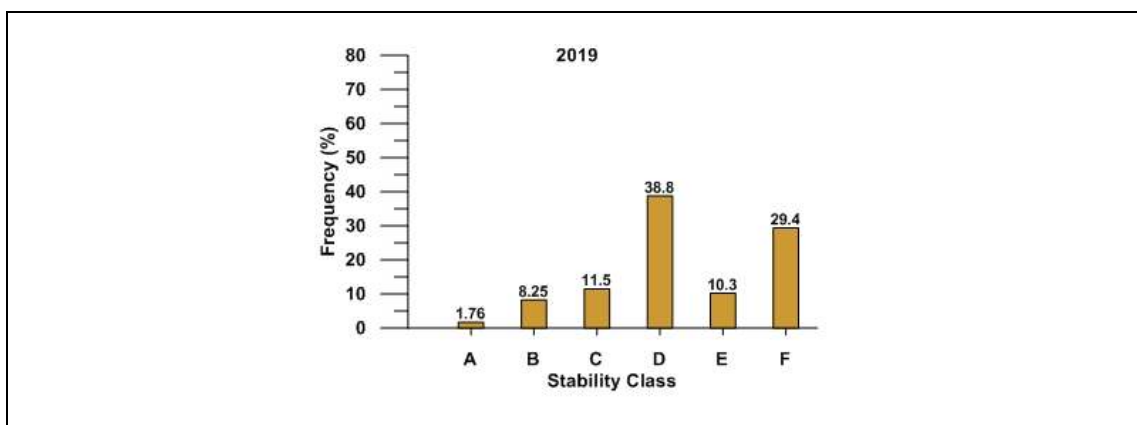
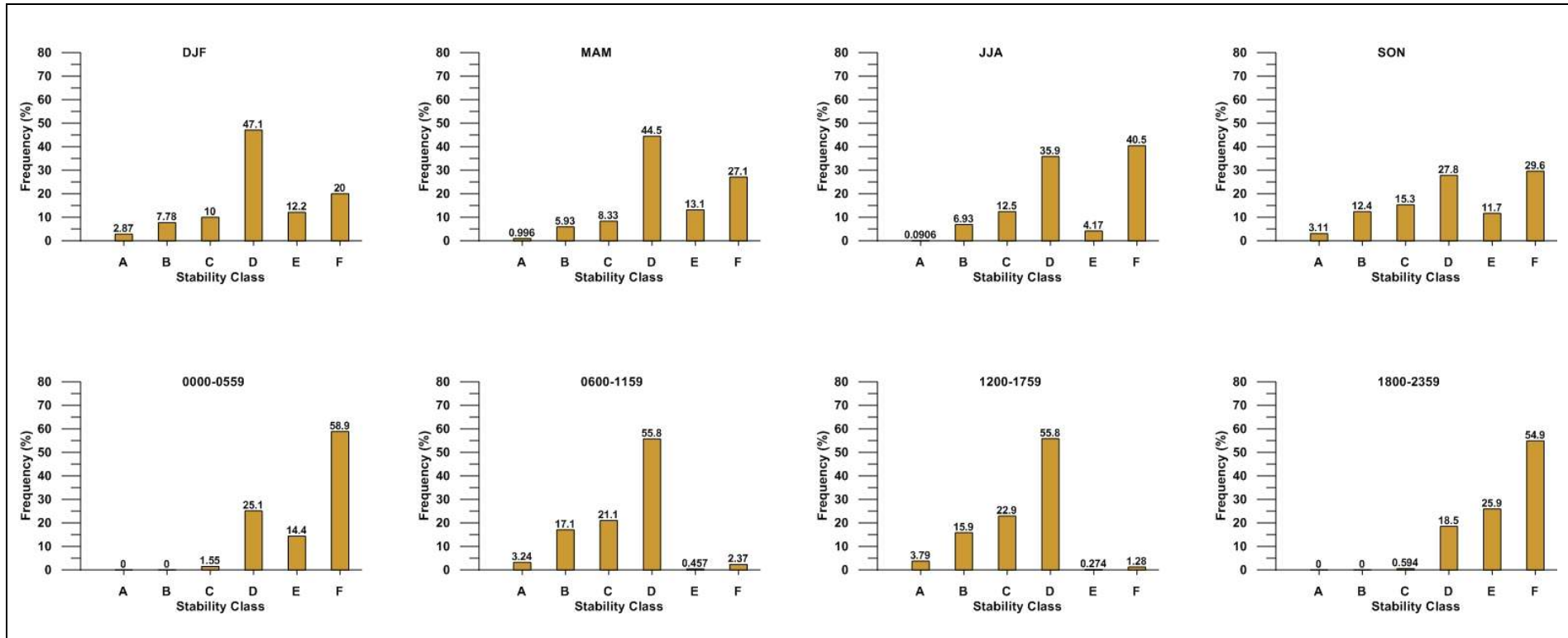


Figure 15: Seasonal Variation in the Stability Class Frequency (upper) and Variation as a Function of the Time of Day (lower) (CALMET 2019)



Note: DJF – December, January, February, MAM – March April May, JJA – June, July, August, SON – September, October, November



Worst Case Meteorological Conditions

In order to effectively manage DNM's dust emissions, a detailed understanding of the meteorological conditions that lead to an increased risk of elevated levels of dust is required. In general, worst-case meteorological conditions for open cut mining operations fall into two categories:

- **Temperature Inversions:** Characterised by calm conditions and the development of low level temperature inversions (typically in winter) that trap dust close to the Earth's surface. Dust levels under these conditions have been observed to increase rapidly over very short periods of time. Inhibiting the dispersion of dust away from the source, the strength and duration of a temperature inversion event can be very difficult to forecast. The collapse of the inversion layer (typically just after sunrise) is associated with a rapid rate of dispersion of the trapped dust and an associated reduction in ground level concentrations.
- **Wind Events:** Elevated wind conditions that lead to the generation of significant windblown dust, particularly from exposed areas. Wind events are typically associated with elevated levels of visible dust and an increase in dust deposition. Wind events in the Bowen Basin are likely associated with summer storms or a synoptic front associated with a regional weather system. The minimum wind speed required to initiate wind erosion will vary depending on the properties of the exposed material, however, in general a lift off velocity of c. 5.4 m/s is suggested by the literature (e.g. NPI, 2012).

Based on the CALMET data set, for the period 1/01/2019 through 31/12/2019, winds above 5.4 m/s were recorded less than c. 3.5% of the time suggesting that significant wind events are not a frequent occurrence at this location.

Appendix B. Dispersion Modelling Methodology

Development of Representative Meteorological Wind Fields

Dispersion modelling typically requires a meteorological dataset representative of the local region based on hourly averages. Parameters required include wind speed, wind direction, temperature, atmospheric stability and mixing height. In general, meteorological observations typically include hourly wind speed, wind direction, temperature, rainfall and humidity. However additional parameters, such as atmospheric stability class and mixing height, are difficult to measure and are often generated through the use of meteorological models. For this assessment the TAPM and CALMET/CALPUFF suite of modelling tools has been used.

TAPM

The meteorological model 'The Air Pollution Model' (TAPM) developed by the Commonwealth Scientific and Industrial Research Organisation (CSIRO) was used to predict initial three-dimensional meteorology for the local airshed. TAPM is a prognostic model used to predict three dimensional meteorological observations, with no local inputs required. The model predicts meteorological datasets consisting of parameters like wind speed, wind direction, temperature, water vapour, cloud, rain, mixing height, atmospheric stability classes etc. that are required for dispersion modelling.

Technical details of the model equations, parameterisations and numerical methods are described in the technical paper by Hurley (2008).

The details of TAPM configuration are summarised in Table 8.

Table 8: TAPM Configuration

Parameter	Units	Value
TAPM version	-	v4.0.5
Years modelled	-	2019
Grid centre	Lat.(degrees), Lon. (degrees)	-22.45833, 148.225
Local centre coordinates	UTM zone 55 S (m)	626042, 7515926
Number of nested grids	-	3
Grid dimensions (nx, ny)	-	41,41
Number of vertical grid levels (nz)	-	25
Grid 1 spacing (dx, dy)	km	30,30
Grid 2 spacing (dx, dy)	km	10,10
Grid 3 spacing (dx, dy)	km	3,3
Local hour	-	GMT + 10

Parameter	Units	Value
Synoptic wind speed maximum	m/s	30
Local met assimilation	-	No
Surface vegetation database	-	Default TAPM V4 database at 3-minute grid spacing (Australian vegetation and soil type data provided by CSIRO Wildlife and Ecology).
Terrain database	-	Default TAPM V4 database at 9-second grid spacing (Australian terrain height data from Geoscience Australia)

CALMET

CALMET (version 6.326) was used to simulate meteorological conditions for the local airshed. CALMET is a diagnostic three dimensional meteorological pre-processor for the CALPUFF modelling system (developed by Earth Tech, Inc.).

Prognostic output from TAPM was used as an initial guess field for the CALMET model. Using high resolution geophysical datasets CALMET then adjusts the initial guess field for the kinematic effects of terrain, slope flows, blocking effects and 3-dimensional divergence minimisation, as well as differential heating and surface roughness associated with different land uses across the modelling domain.

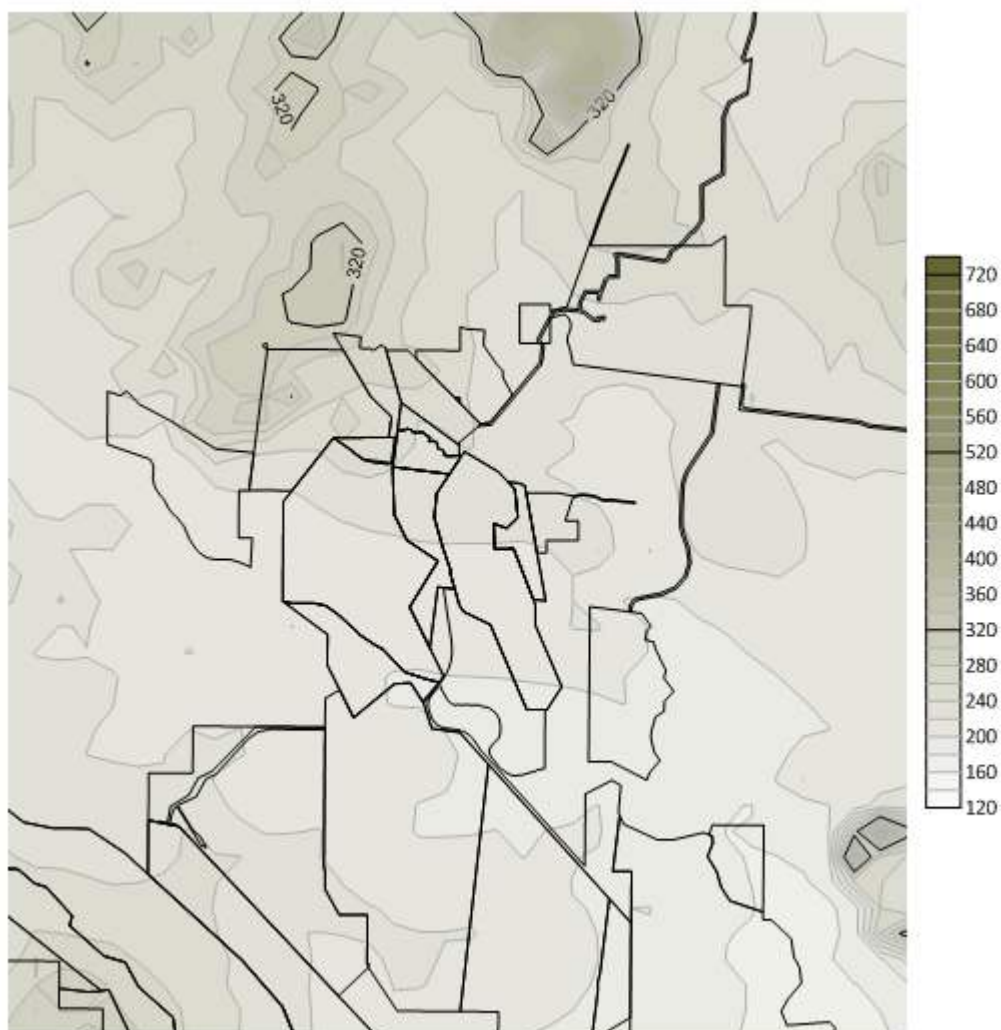
The CALMET model requires three input files along with the control file where the CALMET run parameters are specified and involve: geophysical data; upper air meteorological data; and surface meteorological data.

The Geophysical dataset contain terrain and land use information for the modelling domain.

The terrain information for the project was extracted from 3-arc second (90m) spaced elevation data obtained via NASA's Shuttle Radar Topography Mission (SRTM) in 2000. (Downloaded from USGS website http://dds.cr.usgs.gov/srtm/version2_1/SRTM3/Australia/)

Final terrain data for Geophysical dataset for CALMET is shown in Figure 16.

Figure 16: Terrain data for CALMET Geophysical Dataset



The land use or land cover data for the modelling domain was derived from 300 m resolution Globcover land cover map (© ESA 2010 and UCLouvain, published by European Space science, Dec 2010). Manual edits were performed to take into account the latest mine progressions and urban development within the modelling domain. The ESA classification system was mapped to adopt the user defined CALMET classification system. The Geotechnical parameters for the user defined land use classification were adopted from a combination of closest CALMET and AERMET land use categories.

User defined land use classification and geotechnical parameters used in CALMET are shown in Figure 17 and summarised in Table 9.

Figure 17: Land use classification included in CALMET

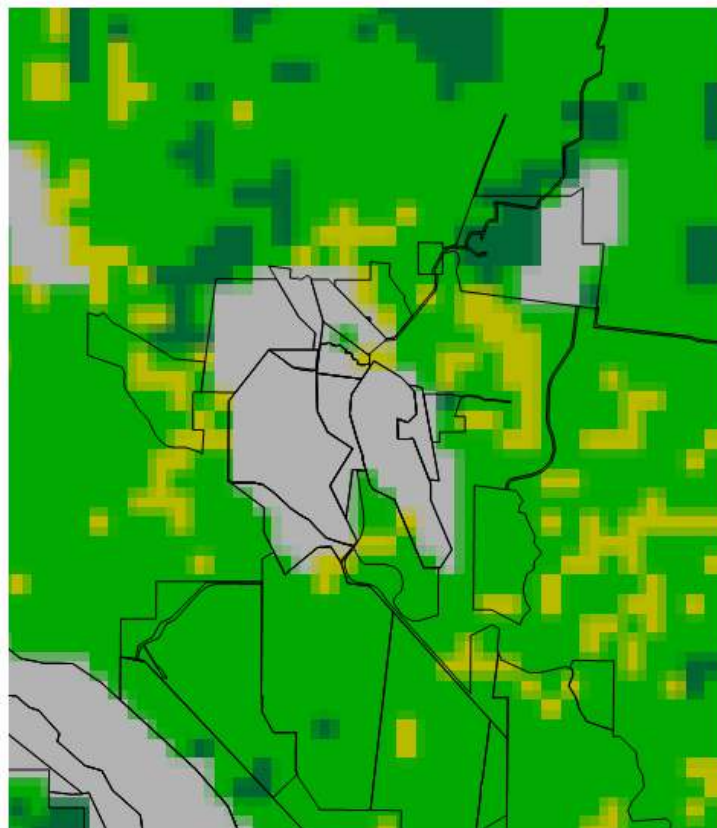


Table 9: CALMET Land use categories included in the assessment

Colour	CALMET User defined Category	ESA Category	AERMET Category
	1	17 Artificial surfaces and associated areas (Urban areas >50%)	Low intensity residential
	2	3 Closed to open (>15%) broadleaved evergreen or semi-deciduous forest (>5m)	Mixed Forest
		5 Open (15-40%) broadleaved deciduous forest/woodland (>5m)	
	3	9 Mosaic forest or shrub land (50-70%) / grassland (20-50%)	Shrub land (Non-arid)
		10 Mosaic grassland (50-70%) / forest or shrub land (20-50%)	
		11 Closed to open (>15%) (broadleaved or needle leaved, evergreen or deciduous) shrub land (<5m)	
		12 Closed to open (>15%) herbaceous vegetation (Grassland, savannas or lichens/mosses)	

Colour	CALMET User defined Category	ESA Category	AERMET Category
		2 Mosaic vegetation (grassland/shrub land/forest) (50-70%/cropland (20-50%))	
	4	13 Sparse (<15%) vegetation	Grassland/Herbaceous
	5	1 Mosaic cropland (50-70%) / vegetation (grassland/shrub land/forest) (20-50%)	Small grains
		0 Rain fed croplands	
	6	-	Quarries/strip mine/gravel

Details of the CALMET configuration are presented in Table 10.

Table 10: CALMET Configuration

Parameter	Units	Value
CALMET version	-	V6.326
Years modelled	-	2019
No. X grid cells (NX)	-	121
No. Y grid cells (NY)	-	121
Grid spacing (DGRIDKM)	km	1
X coordinate (XORIGKM)	km	570.000
Y coordinate (YORIGKM)	km	7460.000
No. of vertical layers (NZ)	-	10
Number of surface stations	-	0
Number of upper air stations	-	0
Maximum radius of influence over land in the surface layer (RMAX1)	km	3
Maximum radius of influence over land aloft (RMAX2)	km	30
Maximum radius of influence over water (RMAX3)	km	10
Radius of influence of terrain features (TERRAD)	km	1
Land use database	-	Manually edited 300 m resolution Globcover land cover map (© ESA 2010 and UCLouvain, published by European Space science, Dec 2010).
Terrain database	-	Manually edited 3-arc second (90m) spaced elevation data obtained

Parameter	Units	Value
		via NASA's Shuttle Radar Topography Mission (SRTM) in 2000
Minimum overland mixing height (ZIMIN)	m	50
Maximum overland mixing height (ZIMAX)	m	3000
UTC time zone (ABTZ)	Hours	UTC+1000

CALPUFF

Dust dispersion modelling was undertaken using the US EPA approved CALPUFF model for 2019 meteorological conditions at 100 m resolution using wind fields developed by CALMET. General run control parameters and technical options that were selected are presented in Table 11. Defaults were used for all other options.

Table 11: CALPUFF Configuration

Parameter	Units	Value
CALPUFF version	-	V6.263
Years modelled	-	2019
No. of vertical layers (NZ)	-	10
UTC time zone (XBTZ)	Hours	UTC+1000
Method used to compute dispersion coefficient (MDISP)	-	2 (internally calculated sigma v, sigma w using micrometeorology)
Computational grid size and resolution	-	Identical to CALMET grid
Sampling grid size and resolution	-	Identical to CALMET grid
Discrete receptors height above ground	m	1.5
Wet deposition		False
Dry deposition		True

Modelling Assumptions and Implications

A necessary component of any air quality assessment is the need to incorporate a wide range of assumptions, the consequence(s) of which can be difficult to quantify. Nonetheless, a summary of some of the key assumptions that have been incorporated into the dust

dispersion modelling methodology utilised for this assessment, the implication(s) of these assumptions and comments are summarised in Table 12.

Table 12: Modelling Assumptions and Implications

Category	Assumption	Implication and Comments
Background levels	Single value applicable for all locations and all times of the year	The use of a single value for background levels masks the spatial and temporal variability.
Background levels	Daily varying background levels	<p>The addition of daily varying background levels when developing the results for the 24 hour average concentration of PM₁₀ provides a more representative indication of the nature and extent of possible conditions within which mining operations will be required to manage air quality impacts.</p> <p>The DETSI Moranbah (Utah Drive) data set for 2019 has not been edited and thus includes contributions for all dust emission sources that impacted upon the station during that time.</p> <p>The use of data for 2019, when the region was in the height of drought conditions, further highlights possible worst-case background conditions. The 2019 data set includes a total of 33 PM₁₀ exceedance days.</p>
Impact of rain days	Rainfall not included	The dust dispersion model methodology adopted for this assessment does not explicitly include rainfall as the validation of rainfall frequency and intensity would add another level of uncertainty when interpreting results. The omission of rainfall from the assessment methodology would suggest that results presented are likely to be more representative of drier years and conservative during periods of above average rainfall.
Emission Factors	Based on the NPI Emission Estimation Technique Manual for Mining V3.1 (NPI EETM)	<p>The NPI EETM (NPI, 2012) has been used to estimate the amount of PM₁₀ emitted from the various mining activities and were supplemented with those from the US EPA's AP42 (USEPA, 1995) as required and/or considered appropriate.</p> <p>Important parameters that are used in the NPI EETM emission factor formulas associated with material handling include silt and moisture content. However, as a comprehensive site-specific data set pertaining to these parameters for overburden (as an example), adopted values have been assumed based on information contained in the US EPA AP42 (1995).</p> <p>It is acknowledged that the lack of comprehensive site-specific material parameter information may limit the representativeness of the emission factors developed for this assessment.</p>

Appendix C. Emissions Factors

The National Pollutant Inventory (NPI) has a series of Emission Estimation Technique Manuals that are intended to provide data on emissions of air pollutants during typical operations. The NPI Emission Estimation Technique Manual (EETM) for Mining V3.1 (NPI, 2012) has been used to provide data to estimate the amount of TSP and PM₁₀ emitted from the various activities on a mine site, based on the amount of coal and overburden material mined as provided by the Proponent. Emission factors from the NPI EETM for Mining were supplemented with those from the US EPA's AP42 (USEPA, 1995) as required and/or when considered appropriate.

Presented in Table 13 is a summary of the assumed values for the moisture content, silt content and density of coal, overburden and topsoil as required as input in the development of the emission factors. Note that there was no site-specific data pertaining to the silt and moisture content of overburden at the time of the assessment. Values have been assumed based on information contained in the US EPA AP42 (1995). It is acknowledged that the lack of site-specific material parameter information may limit the representativeness of the emission factors developed for this study.

Table 13: Material Parameters

Material	units	Value	Reference
Moisture Content			
Overburden	%	3.2	Assumed based on US EPA AP42 table 11.9.3
Coal – RoM	%	4	BMA (previous DNM owner/operators)
Coal - Raw	%	6	BMA (previous DNM owner/operators)
Coal - Product	%	9	BMA (previous DNM owner/operators)
Silt Content			
Overburden	%	6.9	Assumed based on US EPA AP42 table 11.9.3
Road	%	4.3	Assumed based on US EPA AP42 table 11.9.3
Coal	%	5	BMA (previous DNM owner/operators)
exposed areas	%	6.9	Assumed based on overburden silt content
Density			
Overburden	g/cm3	2.2	BMA (previous DNM owner/operators)
Coal	g/cm3	1.51	BMA (previous DNM owner/operators)

Emission Factors

Presented in Table 15 and Table 14 is a summary of the uncontrolled and controlled TSP and PM₁₀ emission factors adopted for this assessment.

Table 14: Emission Factors Used to Develop the Emissions Inventories

Units	Activity	TSP EF	PM10 EF	TSP EF	PM10 EF	TSP EF	PM10 EF
		Uncontrolled EF		Control		Controlled EF	
kg/hr	Dozer (In pit - coal)	5.82	1.2093	0%	0%	5.82	1.2093
kg/hr	Dozer (In pit - OB)	5.82	1.2093	0%	0%	5.82	1.2093
kg/hr	Dozer (OB Dumps)	5.82	1.2093	0%	0%	5.82	1.2093

Table 15: Emission Factors Used to Develop the Emissions Inventories (continued)

EF Units			TSP										
Dig	Dump	Haul	Material	Description	Uncontrolled EF			Control			Controlled EF		
kg/tonne	kg/tonne	kg/VKT			Dig	Dump	Haul	Dig	Dump	Haul	Dig	Dump	Haul
kg/tonne	kg/tonne	kg/VKT	Coal	CAT 793F Coal	0.029	0.01	4.86	0%	50%	75%	0.029	0.005	1.215
kg/tonne	kg/tonne	kg/VKT	OB Waste	CAT 793F Waste	0.025	0.012	4.86	0%	0%	75%	0.025	0.012	1.215
kg/tonne	kg/tonne	kg/VKT	OB Waste	CAT 797F Waste	0.025	0.012	5.65	0%	0%	75%	0.025	0.012	1.412

EF Units			PM 10										
Dig	Dump	Haul	Material	Description	Uncontrolled EF			Control			Controlled EF		
kg/tonne	kg/tonne	kg/VKT			Dig	Dump	Haul	Dig	Dump	Haul	Dig	Dump	Haul
kg/tonne	kg/tonne	kg/VKT	Coal	CAT 793F Coal	0.014	0.004	1.32	0%	50%	75%	0.014	0.002	0.330
kg/tonne	kg/tonne	kg/VKT	OB Waste	CAT 793F Waste	0.012	0.004	1.32	0%	0%	75%	0.012	0.004	0.330
kg/tonne	kg/tonne	kg/VKT	OB Waste	CAT 797F Waste	0.012	0.004	1.53	0%	0%	75%	0.012	0.004	0.383



Appendix D. Emissions Inventories

This appendix presents a summary of the emissions inventory for the Project With (BAU) case and the Project Without (BAU) case.

The Project Without (BAU) Case

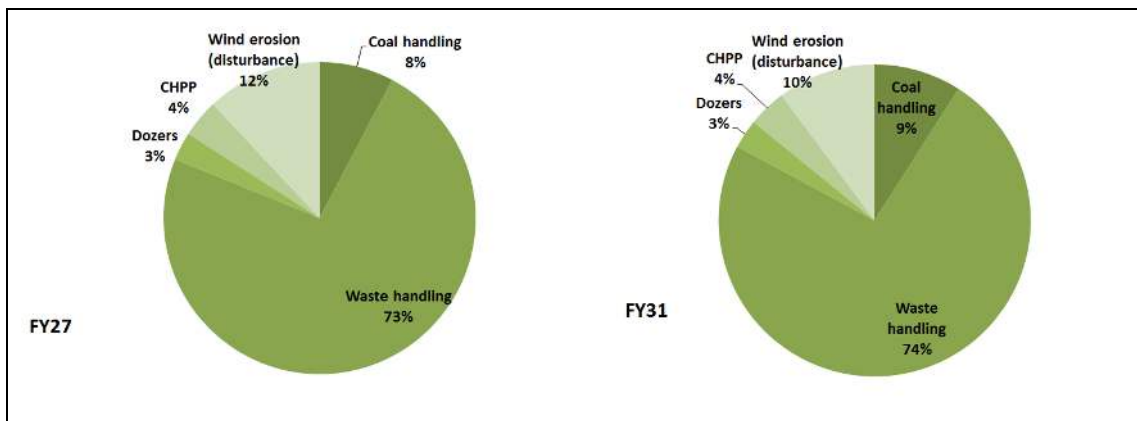
The PM₁₀ and TSP emissions inventory for the Project Without (BAU) case for selected years of mining is presented in Table 16.

The breakdown of the emissions inventory by activity Figure 18 highlights waste handling and wind erosion as key sources of dust.

Table 16: Project Without (BAU) Case: Emissions Inventories

Activity	TSP (t/year)		PM10 (t/year)		PM2.5 (t/year)	
	FY28	FY31	FY28	FY31	FY28	FY31
Coal handling	279	324	263	307	53	61
Waste handling by truck & shovel	4,534	4,454	2,514	2,504	503	501
Dozers	384	389	101	102	20	20
CHPP	134	134	134	134	27	27
Wind erosion (disturbance)	820	691	410	345	82	69
Subtotal (excluding wind erosion)	5,331	5,301	3,012	3,047	602	609
Total	6,152	5,991	3,422	3,393	684	679

Figure 18: Project Without (BAU) Case: Breakdown of Emissions Inventory for PM₁₀



The Project With (BAU) Case

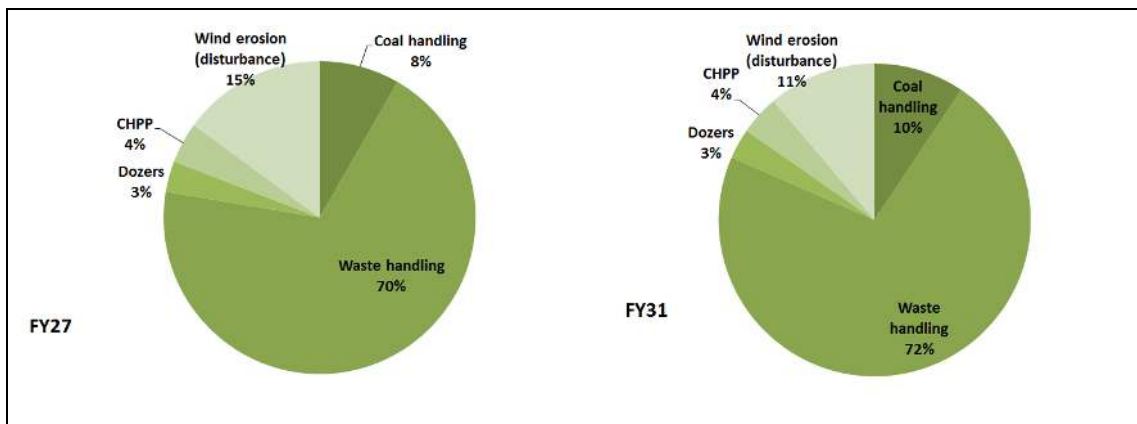
The PM₁₀ and TSP emissions inventory for the Project With (BAU) case for selected years of mining is presented in Table 17.

The breakdown of the emissions inventory by activity presented in Figure 19 highlights waste handling and wind erosion as key sources of dust.

Table 17: Project With (BAU) Case: Emissions Inventories

Activity	TSP (t/year)		PM10 (t/year)		PM2.5 (t/year)	
	FY28	FY31	FY28	FY31	FY28	FY31
Coal handling	279	324	263	307	53	61
Waste handling by truck & shovel	3,674	4,064	2,193	2,359	429	472
Dozers	384	389	101	102	20	20
CHPP	134	134	134	134	27	27
Wind erosion (disturbance)	944	734	472	367	94	73
Subtotal (excluding wind erosion)	4,471	4,911	2,692	2,902	538	580
Total	5,416	5,645	3,164	3,269	633	654

Figure 19: Project With (BAU) Case: Breakdown of Emissions Inventory for PM₁₀



Appendix E. Detailed Results of the Dispersion Modelling

This appendix presents the detailed results from the Project With case and Project Without case.

Interpretation of Results from the Dispersion Modelling

When interpreting results from the dispersion modelling presented in this section it is important to note the following:

- Modelling presented as the BAU Case includes the dust reduction measures specified in Section 4.3. Thus the results provide an indication of how frequently implementation of additional dust control measures may need to be implemented. Modelling of additional scenarios to investigate the extent to which additional mitigation measures may be required has been undertaken with results presented in Appendix F
- Results should not be interpreted as being indicative of environmental outcomes as operations will be required to modify activities in order to comply with the site's current and/or future EA Conditions. Instead, an increase in the predicted number of days for which BAU dust management strategies may be insufficient to ensure compliance with EA requirements (for example), is interpreted as an indication of the increased frequency by which additional dust management strategies may need to be implemented, and therefore represents an increase in operational risk.

Results for Dust Deposition

Presented in Table 18 are the results from the dispersion modelling for the average over the LoM of the maximum monthly averaged dust deposition for comparison with the assessment objective of 120 mg/m²/day (Table 2). Results represent the contribution of mining operations above the background level for dust deposition indicated in the table (see also Table 4).

In contrast, results presented in Table 19 represent the mine contribution to the average monthly-averaged dust deposition.

Results highlight assessment location R1 as being associated with the greatest operational risk with both cases predicting exceedances of the assessment goal over the LoM (Table 18, Table 20).

No significant air quality issues are identified in relation to dust deposition at the location of R2 or R3 due to DNM.

Air quality impacts attributed to the Project are included as the right-most column in the Tables. Results for dust deposition suggest that Project-related impacts are immaterial.

Table 18: Mine Contribution to the Maximum Monthly Average Dust Deposition (mg/m²/day)

Receptor	Project Without Case(BAU)			Project With Case (BAU)			Project Impacts
	FY28	FY31	Average LoM ⁽¹⁾	FY28	FY31	Average LoM ⁽¹⁾	Change in Average LoM
Mine years assessed	1	1	15	1	1	15	15
Background (mg/m ² /day)	38	38	38	38	38	38	n/a
R1	243.2	253.4	186.6	242.3	253.3	186.3	-0.3
R2	9.0	9.8	7.5	9.0	9.9	7.5	0.0
R3	5.3	7.1	5.2	5.3	7.2	5.2	0.0

Note (1): Based on an average of the maximum monthly average dust deposition for each year of the life of mine

Table 19: Mine Contribution to the Average Monthly Average Dust Deposition (mg/m²/day)

Receptor	Project Without Case (BAU)			Project With Case (BAU)			Project Impacts
	FY28	FY31	Average LoM ⁽¹⁾	FY28	FY31	Average LoM ⁽¹⁾	Change in Average LoM
Mine years assessed	1	1	15	1	1	15	15
Background (mg/m ² /day)	38	38	38	38	38	38	n/a
R1	120.5	92.4	67.8	120.5	92.4	67.7	-0.1
R2	2.6	3.0	2.1	2.6	2.9	2.1	0.0
R3	2.3	2.6	1.8	2.3	2.6	1.8	0.0

Note (1): Based on an average of the monthly average dust deposition for each year of the life of mine

Table 20: Additional exceedances of the Monthly Average Dust Deposition

Receptor	Project Without Case (BAU)			Project With Case (BAU)			Project Impacts
	FY28	FY31	Average LoM ⁽¹⁾	FY28	FY31	Average LoM ⁽¹⁾	Change in Average LoM
Mine years assessed	1	1	15	1	1	15	15
Background	0	0	0	0	0	0	n/a
R1	8	6	4.0	8	6	3.9	-0.1
R2	0	0	0.0	0	0	0.0	0.0
R3	0	0	0.0	0	0	0.0	0.0

Note (1): Based on an average of the exceedance months per year for each year of the life of mine inclusive of background levels of dust deposition

Results for TSP

Presented in Table 21 are the results from the dispersion modelling for the annual average concentration of TSP for comparison against the assessment objective of 90 µg/m³ (Table 2).

Results presented represent the contribution above the background level for TSP indicated in the table (see also Table 4).

Results highlight assessment location R1 as being associated with the greatest operational risk with both cases predicting an exceedance of the assessment goal over the LoM (Table 21, Table 22).

No significant air quality issues are identified in relation to the annual average of TSP at the location of R2 or R3 due to DNM.

Air quality impacts attributed to the Project are included as the right-most column in the Tables. Results for TSP suggest that Project-related impacts are immaterial.

Table 21: Mine Contribution to the Annual Average Concentration of TSP ($\mu\text{g}/\text{m}^3$)

Receptor	Project Without Case (BAU)			Project With Case (BAU)			Project Impacts
	FY28	FY31	Average LoM ⁽¹⁾	FY28	FY31	Average LoM ⁽¹⁾	Change in Average LoM
Mine years assessed	1	1	15	1	1	15	15
Background	62.2	62.2	62.2	62.2	62.2	62.2	n/a
R1	71.1	60.1	39.5	71.8	53.6	38.7	-0.8
R2	4.1	4.1	2.8	3.2	3.8	2.7	-0.1
R3	3.8	4.8	3.1	3.7	4.3	3.1	0.0

Note (1): Based on an average of the annual average concentration of TSP for each year of the life of mine

Table 22: Exceedances of the Annual Average Concentration of TSP ($\mu\text{g}/\text{m}^3$)

Receptor	Project Without Case (BAU)			Project With Case (BAU)			Project Impacts
	FY28	FY31	Average LoM	FY28	FY31	Average LoM	Change in Average LoM
Mine years assessed	1	1	15	1	1	15	15
Background	0	0	0	0	0	0	n/a
R1	1	1	0.7	1	1	0.7	0.0
R2	0	0	0.0	0	0	0.0	0.0
R3	0	0	0.0	0	0	0.0	0.0

Results for the 24 Hour Average Concentration of PM₁₀

Presented in Table 23 are the results for the maximum 24 hour average concentration of PM₁₀ for comparison against the assessment objective of 50 $\mu\text{g}/\text{m}^3$ (Table 2). Results presented in the table represent the contribution of mining operations to the maximum 24 hour average concentration of PM₁₀ based on the predicted mine contributions including background levels of dust (see also Table 4).

In contrast, the results presented in Table 24 represent the maximum contribution of mining operations to the maximum 24 hour average concentration excluding background levels of dust.

Results highlight assessment location R1 as being associated with the greatest operational risk with both cases predicting frequent exceedances of the assessment goal over the LoM (Table 23, Table 25).

No significant air quality issues are identified in relation to the 24 hour average concentration of PM₁₀ at the location of R2 or R3 due to DNM.

Air quality impacts attributed to the Project are included as the right-most column in the Tables. Results for the 24 hour average concentration of PM₁₀ suggest that Project-related impacts are immaterial.

Results suggest that there will be an immaterial change in air quality outcomes as a result of the Project.

Table 23: Mine Contribution to the Maximum 24 Hour Average Concentration of PM₁₀ (µg/m³)

Receptor	Project Without Case (BAU)			Project With Case (BAU)			Project Impacts
	FY28	FY31	Average LoM ⁽¹⁾	FY28	FY31	Average LoM ⁽¹⁾	Change in Average LoM
Mine years assessed	1	1	15	1	1	15	15
Background (daily varying)	217.8	217.8	217.8	217.8	217.8	217.8	n/a
R1	0.1	0.0	0.0	0.1	0.0	0.0	0.0
R2	6.1	6.3	3.6	5.1	6.4	3.3	-0.3
R3	11.0	17.5	9.8	9.4	16.1	9.4	-0.4

Note (1): Based on an average of the maximum 24 hour average concentration of PM₁₀ for each year of the life of mine including background levels of dust

Table 24: Maximum Mine Contribution to the Maximum 24 Hour Average Concentration of PM₁₀ (µg/m³)

Receptor	Project Without Case (BAU)			Project With Case (BAU)			Project Impacts
	FY28	FY31	Average LoM ⁽¹⁾	FY28	FY31	Average LoM ⁽¹⁾	Change in Average LoM
Mine years assessed	1	1	15	1	1	15	15
Background	n/a	n/a	n/a	n/a	n/a	n/a	n/a
R1	85.8	101.4	64.6	80.2	79.0	63.9	-0.7
R2	21.2	28.5	22.8	15.1	29.0	22.4	-0.4
R3	26.8	35.5	23.0	26.3	31.7	22.7	-0.3

Note (1): Based on an average of the maximum 24 hour average concentration of PM₁₀ for each year of the life of mine excluding background levels of dust

Table 25: Number of Additional PM₁₀ Exceedance Days

Receptor	Project Without Case (BAU)			Project With Case (BAU)			Project Impacts
	FY28	FY31	Average LoM ⁽¹⁾	FY28	FY31	Average LoM ⁽¹⁾	Change in Average LoM
Mine years assessed	1	1	15	1	1	15	15
Background	33	33	33	33	33	33	n/a
R1	130	110	74.3	132	104	73.7	-0.6
R2	6	6	3.7	5	5	3.5	-0.2
R3	4	8	3.9	3	7	3.6	-0.3

Note (1): Based on an average of the additional number of PM₁₀ exceedances days for each year of the life of mine where background levels of dust have been added to predicted mine contributions.

Results for the Annual Average Concentration of PM₁₀

Presented in Table 26 is a summary of the results for the mine contribution to the annual average concentration of PM₁₀ for comparison with the assessment objective of 25 µg/m³.

Results presented represent the contribution above the annual average background level for PM₁₀ indicated in the table (see also Table 4).

Results highlight assessment location R1 as being associated with the greatest operational risk (Table 26).

As the background level estimate for the annual average concentration of PM₁₀ exceeds the assessment objective (Table 4), exceedances are predicted for both cases at all locations (Table 27).

No significant air quality issues are identified in relation to the mine's contribution to the annual average concentration of PM₁₀ at the location of R2 or R3.

Air quality impacts attributed to the Project are included as the right-most column in the Tables. Results for the annual average concentration of PM₁₀ suggest that Project-related impacts are immaterial.

Table 26: Mine Contribution to the Annual Average Concentration of PM₁₀ (µg/m³)

Receptor	Project Without Case (BAU)			Project With Case (BAU)			Project Impacts
	FY28	FY31	Average LoM ⁽¹⁾	FY28	FY31	Average LoM ⁽¹⁾	Change in Average LoM
Mine years assessed	1	1	15	1	1	15	15
Background	31.1	31.1	31.1	31.1	31.1	31.1	n/a
R1	17.7	14.6	9.8	17.7	13.6	9.7	-0.1
R2	1.1	1.1	0.7	0.9	1.0	0.7	0.0
R3	1.0	1.2	0.8	1.0	1.2	0.8	0.0

Note (1): Based on an average of the annual average concentration of PM₁₀ for each year of the life of mine

Table 27: Number of Exceedance Years of the Annual Average Concentration of PM₁₀ (µg/m³)

Receptor	Project Without Case ⁽¹⁾ (BAU)			Project With Case ⁽¹⁾ (BAU)			Project Impacts
	FY28	FY31	Average LoM	FY28	FY31	Average LoM	Change in Average LoM
Mine years assessed	1	1	15	1	1	15	15
Background	1	1	1	1	1	1	n/a
R1	1	1	1.0	1	1	1.0	0.0
R2	1	1	1.0	1	1	1.0	0.0
R3	1	1	1.0	1	1	1.0	0.0

Note (1): Inclusive of background levels of dust

Results for the 24 Hour Average Concentration of PM_{2.5}

Presented in Table 28 are the results for the mine contribution to the maximum 24 hour average concentration of PM_{2.5} for comparison against the assessment objective of 25 µg/m³ (Table 2).

Results highlight assessment location R1 as being associated with the greatest operational risk with both cases predicting exceedances of the assessment goal over the LoM (Table 28, Table 29).

No significant air quality issues are identified in relation to the 24 hour average concentration of PM_{2.5} at the location of R2 or R3 due to DNM.

Air quality impacts attributed to the Project are included as the right-most column in the Tables. Results for the 24 hour average concentration of PM_{2.5} suggest that Project-related impacts are immaterial.

Table 28: Mine Contribution to the Maximum 24 Hour Average Concentration of PM_{2.5} (µg/m³)

Receptor	Project Without Case ⁽¹⁾ (BAU)			Project With Case ⁽¹⁾ (BAU)			Project Impacts
	FY28	FY31	Average LoM	FY28	FY31	Average LoM	Change in Average LoM
Mine years assessed	1	1	15	1	1	15	15
Background	7.2	7.2	7.2	7.2	7.2	7.2	n/a
R1	27.4	32.1	22.5	25.9	26.4	21.9	-0.6
R2	9.9	12.7	10.0	7.2	12.5	9.8	-0.2
R3	11.8	15.9	11.6	11.6	14.4	11.7	+0.1

Note (1): Based on an average of the maximum 24 hour average concentration of PM_{2.5} for each year of the life of mine

Table 29: Number of PM_{2.5} Exceedance Days

Receptor	Project Without Case ⁽²⁾ (BAU)			Project With Case ⁽²⁾ (BAU)			Project Impacts
	FY28	FY31	Average LoM ⁽¹⁾	FY28	FY31	Average LoM ⁽¹⁾	Change in Average LoM
Mine years assessed	1	1	15	1	1	15	15
Background	0	0	0	0	0	0	n/a
R1	51	40	25.1	53	40	25.2	+0.1
R2	0	0	0.0	0	0	0.0	0.0
R3	0	2	0.4	0	3	0.3	-0.1

Note (1): Based on an average of the PM_{2.5} exceedance days for each year of the life of mine
(2): Inclusive of background levels of dust

Results for the Annual Average Concentration of PM_{2.5}

Presented in Table 30 is a summary of the results for the contribution to the annual average concentration of PM₁₀ at selected assessment locations for comparison with the assessment objective of 7 µg/m³. Results presented represent the contribution above the annual average background level for PM_{2.5} which is indicated in the table (see also Table 4). Results highlight

assessment location R1 as being associated with the greatest operational risk with exceedances of the assessment objective predicted over the LoM (Table 30, Table 31).

No significant air quality issues are identified in relation to the mine's contribution to the annual average concentration of PM_{2.5} at the location of R2 or R3. It is noted however, that the background levels of PM_{2.5} exceed the assessment objective of 7 µg/m³.

Air quality impacts attributed to the Project are included as the right-most column in the Tables. Results for the annual average concentration of PM_{2.5} suggest that Project-related impacts are immaterial.

Table 30: Mine Contribution to the Annual Average Concentration of PM_{2.5} (µg/m³)

Receptor	Project Without Case (BAU)			Project With Case (BAU)			Project Impacts
	FY28	FY31	Average LoM ⁽¹⁾	FY28	FY31	Average LoM ⁽¹⁾	Change in Average LoM
Mine years assessed	1	1	15	1	1	15	15
Background	7.4	7.4	7.4	7.4	7.4	7.4	n/a
R1	6.3	5.3	3.5	6.4	4.9	3.5	0.0
R2	0.4	0.5	0.3	0.4	0.4	0.3	0.0
R3	0.5	0.6	0.4	0.5	0.6	0.4	0.0

Note (1): Based on an average of the annual average concentration of PM_{2.5} for each year of the life of mine

Table 31: Number of Exceedance Years of the Annual Average Concentration of PM_{2.5} (µg/m³)

Receptor	Project Without Case ⁽¹⁾ (BAU)			Project With Case ⁽¹⁾ (BAU)			Project Impacts
	FY28	FY31	Average LoM	FY28	FY31	Average LoM	Change in Average LoM
Mine years assessed	1	1	15	1	1	15	15
Background exceedances	1	1	1.0	1	1	1.0	n/a
R1	1	1	1.0	1	1	1.0	0.0
R2	1	1	1.0	1	1	1.0	0.0
R3	1	1	1.0	1	1	1.0	0.0

Note (1): Inclusive of background levels of dust

Appendix F. Managing Operations

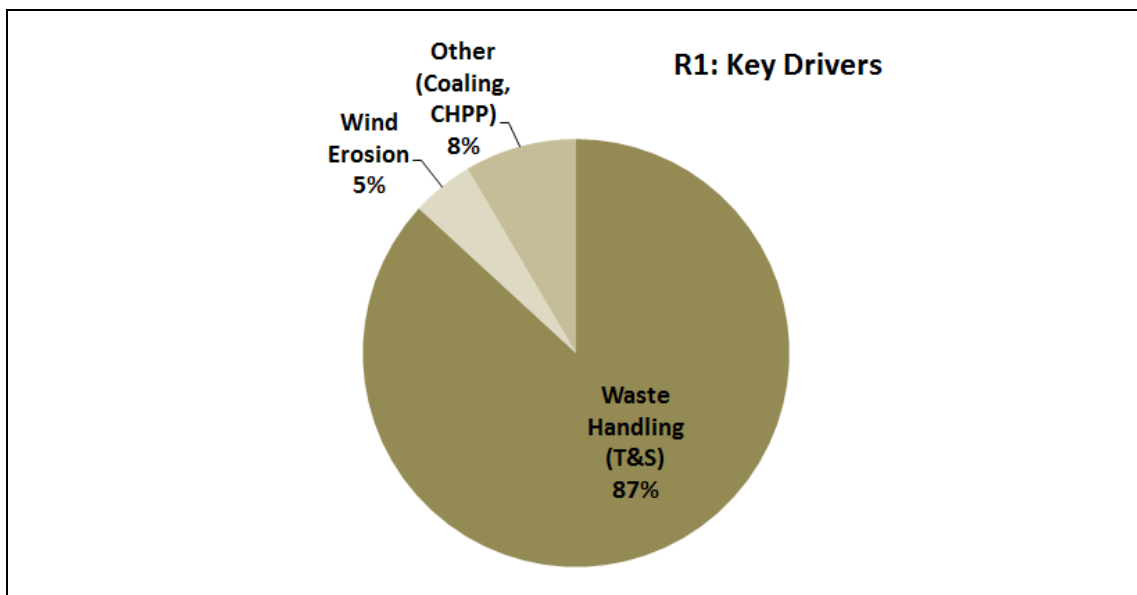
Key Drivers of PM₁₀

In order to develop an understanding of the nature and extent to which additional mitigation measures in excess of BAU dust management practices may be required in order to achieve compliance with the assessment objective of 50 µg/m³ for the 24 hour average concentration of PM₁₀, this section presents the findings of an investigation into the key drivers of predicted dust impacts based on dispersion modelling output.

Presented in Figure 20 is a summary of the identified key drivers at the location of R1 (as the most affected assessment location) for the Project With (BAU) case based on an average over the LoM.

Results suggest that waste handling by truck and shovel mining methods (including loading, hauling and dumping) will be the most significant contributor to dust risk at this location. These findings are not unexpected as waste handling by truck and shovel mining methods was found to be the most significant contributor to the PM₁₀ emissions inventory (Appendix D).

Figure 20: Project With (BAU) Case: Key Drivers at R1 based on an Average over the LoM



Modelled Mitigation Scenarios

Results presented in Appendix E highlighted waste material handling by truck and shovel mining methods as being the key driver to predicted impacts at the location of R1.

Thus, modelled dust reduction scenarios focused on mitigation measures that target waste handling by truck shovel mining methods. A summary of the mitigation scenarios that were investigated is provided in Table 32.

It is noted that the percentage dust reduction for the scenarios listed in the table may be achieved using one or more of a combination of dust mitigation options for example:

- Reducing haul distances where possible
- Reducing vehicle speed and thus vehicle kilometres travelled (VKT) per hour
- Reducing the number of operating trucks

An additional mitigation scenario has been included in Table 32 that focuses on dust mitigation strategies other than truck and shovel mining methods:

- The cessation of all mining activities.

Table 32: Project With (BAU) Case - Mitigation Scenarios

Scenario	Description	Comments
Dust 25% Reduction (T&S)	<ul style="list-style-type: none"> • A reduction in dust emissions associated with Truck & Shovel activity (including loading, hauling and dumping of waste material) by 25% in key source areas on high risk days 	<ul style="list-style-type: none"> • Assumes all other activities are operating as per BAU in key source areas on high risk days⁽¹⁾
Dust 50% Reduction (T&S)	<ul style="list-style-type: none"> • A reduction in dust emissions associated with Truck & Shovel activity (including loading, hauling and dumping of waste material) by 50% in key source areas on high risk days 	<ul style="list-style-type: none"> • Assumes all other activities are operating as per BAU in key source areas on high risk days⁽¹⁾
Dust 75% Reduction (T&S)	<ul style="list-style-type: none"> • A reduction in dust emissions associated with Truck & Shovel activity (including loading, hauling and dumping of waste material) by 75% in key source areas on high risk days 	<ul style="list-style-type: none"> • Assumes all other activities are operating as per BAU in key source areas on high risk days⁽¹⁾
Dust 100% Reduction (T&S)	<ul style="list-style-type: none"> • A reduction in Truck & Shovel activity by 100% (i.e. stopped operating) in key source areas on high risk days 	<ul style="list-style-type: none"> • Assumes all other activities are operating as per BAU in key source areas on high risk days⁽¹⁾
Shutdown	<ul style="list-style-type: none"> • All mining activities have ceased. 	<ul style="list-style-type: none"> • Assumes all activities in key source areas on high risk days⁽¹⁾ have ceased operating.

Scenario	Description	Comments
<p>Note (1): A 'high risk day' refers to days when worst case meteorological conditions (Appendix A) and the location and intensity of mining activities combine in such a way as to elevate the risk of adverse dust impacts at off site locations.</p>		

Results from the Mitigation Scenarios

Presented in Table 33 (and illustrated in Figure 21) are the results from the dispersion modelling for the PM₁₀ mitigation scenarios (Table 32) highlighting the extent to which additional dust control measures may be required to mitigate the predicted PM₁₀ exceedance days.

When interpreting the results presented in the figures the following are noted:

- The number in the first column associated with the BAU Case indicates the average number of exceedance days per year of the assessment objective of 50 µg/m³ for the 24 hour average concentration of PM₁₀ that are predicted to occur over the LoM inclusive of daily varying background levels.
- The value above the remaining columns highlights the number of exceedances days per year that are mitigated by implementing the noted mitigation measure when required.
- For example, the mitigation of the 106.7 days per year on average over the LoM) dust exceedance days at the location of R1 would involve the following levels of modification of operational practices:
 - 13.1 days with a 25% reduction in waste handling by truck and shovel.
 - 18.1 days with a 50% reduction in waste handling by truck and shovel.
 - 20.2 days with a 75% reduction in waste handling by truck and shovel.
 - 15.9 days with a 100% reduction in waste handling by truck and shovel.
 - Shutting down mining operations on 4.5 days.
 - However, results of the mitigation scenarios suggest that the modification of day-to-day operations (i.e. on a total of 71.7 days on average per year over the LoM) will not be sufficient to mitigate all of the predicted exceedance days at the location of R1, with the disturbance footprint alone, predicted to result in 2.0 exceedance days (on average per year), and background dust levels associated with 33 exceedance days.

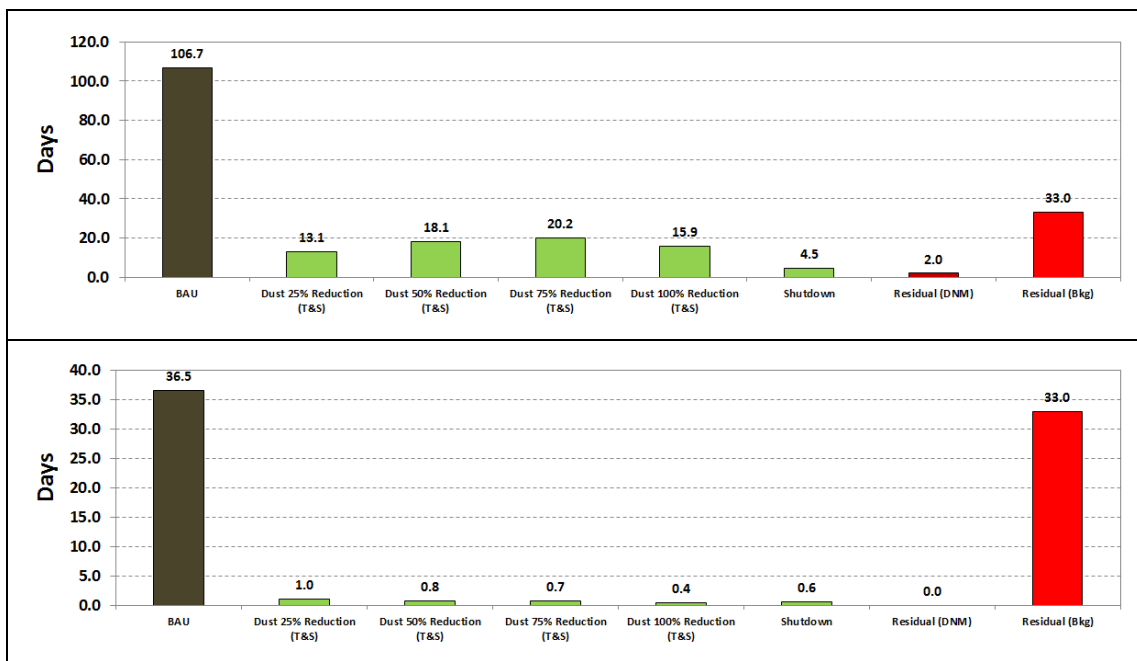
In general, results suggest that with the exception of exceedance days driven by significant wind erosion associated with the scale of the disturbance footprint, the range of mitigation measures available to site to inform day-to-day operations, will in general be sufficient to adequately manage operational dust risk associated with DNM mining operations in isolation of other significant dust emission sources.

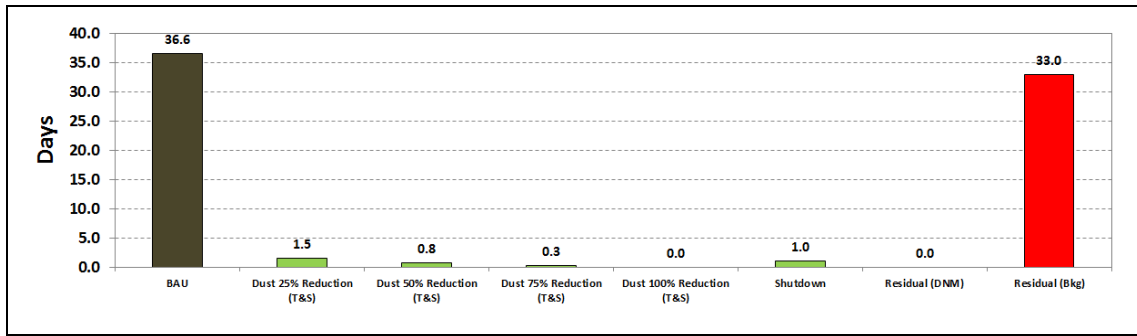
Table 33: Results from the Project With Case Mitigation Scenarios

Location	BAU ⁽¹⁾	Dust 25% Reduction (T&S)	Dust 50% Reduction (T&S)	Dust 75% Reduction (T&S)	Dust 100% Reduction (T&S)	Shutdown	Residual (DNM)	Residual (Background)
R1	106.7	13.1	18.1	20.2	15.9	4.5	2.0	33
R2	36.5	1.0	0.8	0.7	0.4	0.6	0.0	33
R3	36.6	1.5	0.8	0.3	0.0	1.0	0.0	33

Note (1): Inclusive of daily varying background levels. (Compare with results presented in Table 25 based on additional exceedances, added to those included in the background levels)

Figure 21: Results from Mitigation Scenarios for: R1 (upper), R2 (middle), R3 (lower)





Summary of Results for the Project With Cases

Presented in Table 34 is a comparison of the predicted number of PM₁₀ exceedance days for the Project With (BAU) Case (Appendix E) and the Project With (Fully Mitigated) Case.

Results presented in the table suggest that with the exception of significant wind events, the range of mitigation measures available to site will in general be sufficient to adequately manage operational dust risk.

Table 34: Comparison of BAU and Fully Mitigated Project With Cases – Additional PM₁₀ Exceedance Days

Receptor	Project With Case (BAU)			Project With Case ⁽¹⁾ (Fully Mitigated)
	FY28	FY31	Average LoM	Average LoM
Mine years assessed	1	1	15	15
Background	33	33	33	33
R1	132	104	73.7	2.0
R2	5	5	3.5	0.0
R3	3	7	3.6	0.0

Note (1) Residual exceedance days are attributed to significant wind events